

design/build outline
performance specification

August 10, 2009

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

project manual

prepared for:

state of utah

department of facilities construction and management

4110 state office building, salt lake city, utah 84111

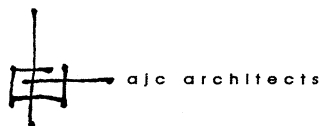
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Design/Build Outline Performance Specification
TABLE OF CONTENTS

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

Section	Title	Pages
	PROJECT MANUAL TABLE OF CONTENTS	1 – 6
DIVISION 1 - GENERAL REQUIREMENTS		
	(FURNISHED BY DFCM)	
	INSTRUCTIONS AND SUBCONTRACTORS LIST FORM	1 – 3
	CM GC AGREEMENT	1 – 17
	TAX EXEMPTION CERTIFICATE	1 – 1
	BID BOND	1 – 1
	PERFORMANCE BOND	1 – 1
	PAYMENT BOND	1 – 1
	GENERAL CONDITIONS TABLE OF CONTENTS	1 – 4
	GENERAL CONDITIONS	1 – 47
CHECKLISTS, CERTIFICATES AND REPORTS		
	DFCM DESIGN REVIEW CHECKLIST	1 – 6
	INTERIOR LIGHTING AND POWER COMPLIANCE CERTIFICATE	1 – 6
	DOE-2 ENERGY MODEL DRAFT	1 – 12
	LEED-NC V2.2 REGISTERED PROJECT CHECKLIST	1 – 6
	GEOTECHNICAL ENGINEERING REPORT	(SEE PROGRAMING DOCUMENT)
DIVISION 1 -GENERAL REQUIREMENTS		
011000	SUMMARY	1 – 2
012500	SUBSTITUTION PROCEDURERS	1 – 1
012600	CONTRACT MODIFICATION PROCEDURES	1 – 1
012900	PAYMENT PROCEDURES	1 – 1
013100	PROJECT MANAGEMENT AND COORDINATION	1 – 1
013200	CONSTRUCTION PROGRESS DOCUMENTATION	1 – 2
013233	PHOTOGRAPHIC DOCUMENTATION	1 – 1
013300	SUBMITTAL PROCEDURES	1 – 1
014000	QUALITY REQUIREMENTS	1 – 2
014200	REFERENCES	1 – 1
015000	TEMPORARY FACILITIES AND CONTROLS	1 – 3
016000	PRODUCT REQUIREMENTS	1 – 2
017300	EXECUTION	1 – 2
017419	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL	1 – 1

017700	CLOSEOUT PROCEDURES	1 – 2
017823	OPERATION AND MAINTENANCE DATA	1 – 1
017839	PROJECT RECORD DOCUMENTS	1 – 1
017900	DEMONSTRATION AND TRAINING	1 – 1
018113	SUSTAINABLE DESIGN REQUIREMENTS	1 – 2
	FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION	1 – 1
	FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN	1 – 1
	FORM CWM-5: COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION	1 – 1
	FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT	1 – 1
019113	GENERAL COMMISSIONING REQUIREMENTS	1 – 1
DIVISION 02 – EXISTING CONDITIONS		
(NOT USED)		
DIVISION 3 - CONCRETE		
033000	CAST-IN-PLACE CONCRETE	1 – 2
033300	ARCHITECTURAL CONCRETE	1 – 1
DIVISION 4 - MASONRY		
042000	UNIT MASONRY	1 - 2
DIVISION 5 - METALS		
051200	STRUCTURAL STEEL FRAMING	1 – 2
052100	STEEL JOIST FRAMING	1 – 1
053100	STEEL DECKING	1 – 1
054000	COLD-FORMED METAL FRAMING	1 – 2
055000	METAL FABRICATIONS	1 – 1
055100	METAL STAIRS	1 – 1
055213	PIPE AND TUBE RAILINGS	1 – 1
DIVISION 6 - WOOD AND PLASTICS		
061050	MISCELLANEOUS CARPENTRY	1 – 2
064023	INTERIOR ARCHITECTURAL WOODWORK	1 – 2
066400	PLASTIC PANELING	1 – 1
DIVISION 7 - THERMAL AND MOISTURE PROTECTION		
071113	BITUMINOUS DAMPPROOFING	1 – 1
072100	BUILDING INSULATION	1 – 1
074113	METAL ROOF PANELS	1 – 2
074213	METAL WALL PANELS	1 – 2
075423	THERMOPLASTIC POLYOLEFIN (TPO) ROOFING	1 – 2
076200	SHEET METAL FLASHING AND TRIM	1 – 1

077200	ROOF ACCESSORIES	1 – 1
079200	JOINT SEALANTS	1 – 2

DIVISION 8 - OPENINGS

081110	STANDARD STEEL DOORS AND FRAMES	1 – 2
081416	FLUSH WOOD DOORS	1 – 1
083110	ACCESS DOORS AND FRAMES	1 – 1
084113	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS	1 – 3
087100	DOOR HARDWARE	1 – 1
088000	GLAZING	1 – 2

DIVISION 9 - FINISHES

092216	NON-LOAD BEARING STEEL FRAMING	1 – 1
092500	GYPSUM BOARD	1 – 1
093000	TILING	1 – 2
095113	ACOUSTICAL PANEL CEILINGS	1 – 1
096340	STONE FLOORING	1 – 2
096510	RESILIENT BASE AND ACCESSORIES	1 – 1
096516	RESILIENT SHEET FLOORING	1 – 1
096520	RESILIENT TILE FLOORING	1 – 1
096820	TILE CARPETING	1 – 1
099120	INTERIOR PAINTING	1 – 1
099600	HIGH-PERFORMANCE COATINGS	1 – 8

DIVISION 10 – SPECIALTIES

101100	VISUAL DISPLAY SURFACES	1 – 1
101400	SIGNAGE	1 – 2
102113	TOILET COMPARTMENTS	1 – 1
102600	WALL AND DOOR PROTECTION	1 – 1
102800	TOILET, BATH, AND LAUNDRY ACCESSORIES	1 – 1
105113	METAL LOCKERS	1 – 1
105200	FIRE-PROTECTION SPECIALTIES	1 – 1

DIVISION 11 - EQUIPMENT

(NOT USED)

DIVISION 12 - FURNISHINGS

(NOT USED)

DIVISION 13 - SPECIAL CONSTRUCTION

(NOT USED)

DIVISION 14 - CONVEYING SYSTEMS

142400	HYDRAULIC ELEVATORS	1 – 2
DIVISION 21 - FIRE SUPPRESSION		
	SPECIFICATION INDEX SECTIONS 21, 22 AND 23	1 – 1
211000	FIRE PROTECTION	1 – 1
DIVISION 22 - PLUMBING		
220523	GENERAL DUTY VALVES FOR PLUMBING PIPING	1 – 1
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT	1 – 1
220548	VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT	1 – 1
220553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT	1 – 1
220700	PLUMBING PIPING INSULATION	1 – 2
221113	FACILITY WATER DISTRIBUTION PIPING	1 – 3
221313	FACILITY SANITARY SEWERS	1 – 1
221410	PLUMBING PIPING	1 – 2
221411	DISENFECTING WATER SUPPLY SYSTEM	1 – 1
221430	PLUMBING SPECIALTIES	1 – 7
223500	DOMESTIC WATER HEAT EXCHANGERS	1 – 1
224440	PLUMBING FIXTURES	1 – 4
224450	PLUMBING EQUIPMENT	1 – 1
226113	COMPRESSED AIR FOR LABORATORIES AND HEALTHCARE FACILITIES	1 – 1
226119	COMPRESSED AIR FOR LABORATORY AND HEALTHCARE FACILITIES	1 – 2
226213	VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES	1 – 1
226219	VACUUM EQUIPMENT FOR LABORATORY AND HEALTHCARE FACILITIES	1 – 1
DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING		
230500	BASIC MECHANICAL REQUIREMENTS	1 – 2
230523	GENERAL-DUTY VALVES FOR HVAC PIPING	1 – 2
230529	BASIC MECHANICAL MATERIALS AND METHODS	1 – 1
230539	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	1 – 1
230548	VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT	1 – 2
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT	1 – 1
230593	TESTING, ADJUSTING, AND BALANCING FOR HVAC	1 – 1
230700	MECHANICAL INSULATION	1 – 1
232113	HVAC SPECIALTIES	1 – 1
230900	INSTRUMENTATION AND CONTROL FOR HVAC	1 – 3
232123	HVAC PUMPS	1 – 1
232213	STEAM AND CONDENSATE HEATING PIPING	1 – 2
232223	STEAM CONDENSATE PUMPS	1 – 1

232500	HVAC WATER TREATMENT	1 – 2
233300	DUCTWORK AND ACCESSORIES	1 – 2
233400	AIR HANDLING FANS	1 – 1
233410	SPECIAL EXHAUST SYSTEMS	1 – 1
233600	AIR TERMINAL UNITS	1 – 1
233713	AIR INLETS AND OUTLETS	1 – 1
235550	SOLAR ENERGY SYSTEMS	1 – 7
235700	HEAT TRANSFER	1 – 1
236400	REFRIGERATION	1 – 1
236426	ROTARY-SCREW WATER CHILLERS	1 – 2
236500	COOLING TOWERS	1 – 2
237313	MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS	1 – 2

DIVISION 26, 27, 28 – ELECTRICAL

260513	MEDIUM-VOLTAGE CABLES	1 – 1
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	1 – 2
260523	CONTROL-VOLTAGE ELECTRICAL POWER CABLES	1 – 2
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING	1 – 1
260548	VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS	1 – 1
261200	MEDIUM-VOLTAGE TRANSFORMERS	1 – 2
261300	MEDIUM-VOLTAGE SWITCHGEAR	1 – 1
262200	LOW-VOLTAGE TRANSFORMERS	1 – 2
262413	SWITCHBOARDS	1 – 3
262416	PANELBOARDS	1 – 3
262419	MOTOR CONTROL CENTERS	1 – 1
262913	ENCLOSED CONTROLLERS	1 – 1
263213	ENGINE GENERATORS	1 – 2
263323	CENTRAL BATTERY EQUIPMENT	1 – 2
270544	SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING	1 – 1
271100	COMMUNICATIONS EQUIPMENT ROOM FITTINGS	1 – 2
271300	COMMUNICATIONS BACKBONE CABLING	1 – 2
271500	COMMUNICATIONS HORIZONTAL CABLING	1 – 2
275313	CLOCK SYSTEMS	1 – 1
284000	SOUND SYSTEMS	1 – 2

DIVISION 31 – EARTHWORK

311100	SITE CLEARING	1 – 1
312000	EARTH MOVING	1 – 2

312500	EROSION AND SEDIMENTATION CONTROLS	1 – 1
311300	TREE PROTECTION	1 – 4
DIVISION 32 – EXTERIOR IMPROVEMENTS		
321216	ASPHALT PAVING	1 – 2
321313	CONCRETE PAVING	1 – 2
328423	IRRIGATION SYSTEM	1 – 5
329000	LANDSCAPING	1 – 8
DIVISION 33 – UTILITIES		
334110	STORM UTILITY DRAINAGE PIPING	1 – 2
334600	SUBDRAINAGE	1 – 1
335100	NATURAL GAS DISTRIBUTION	1 – 2
END OF OUTLINE SPECIFICATION TABLE OF CONTENTS		

SECTION 011000 - SUMMARY

1.1 PROJECT INFORMATION

- A. Project Identification: Ogden Weber Applied Technology College, Health Technology Building.
 - 1. Project Location: Ogden-Weber Applied Technology College, 200 north, Washington Blvd., Ogden, Utah, 84404.
- B. Owner: State of Utah, Department of Facilities and Construction Management.
 - 1. Owner's Representative: Dave McKay, State of Utah DFCM.
- C. Architect: Programming – ajc architects.
- A. Design-BUILDER: To be determined through Design/Build process.
- B. Project Web Site: Administered by the Construction Manager.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work of the Project: New construction for a two story Applied Technology College training center, 65,000 square feet finished area, 5,200 square feet of shell space.
- B. Type of Contract: single prime Design/Build contract.
- C. Phased Construction: one primary phase.
- D. Work by Owner:
 - 1. Preceding Work: Geotechnical Report.
 - 2. Concurrent Work: Telecommunications and Data systems.
 - 3. Subsequent Work: Furnishings.
- E. Purchase Contracts: Owner has negotiated purchase contracts.
 - 1. Refer to Division 09 Section "Carpeting."
- F. Owner-Furnished Products:
 - 1. Carpeting.
- G. Use of Site: Limited to work in areas indicated.
 - 1. Owner occupancy and use by public of adjacent campus facilities allowed.
- H. Owner's Occupancy Requirements: Partial Owner occupancy.
 - 1. Owner occupancy of completed areas of construction.

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

I. Work Restrictions: Normal construction hours.

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

1.1 SUBMITTALS

- A. Substitution Request Form: CSI Form 13.1A.
- B. Documentation:
 - 1. Justification.
 - 2. Coordination information.
 - 3. Detailed comparison.
 - 4. Product Data.
 - 5. Samples.
 - 6. Certificates and qualification data.
 - 7. List of similar installations.
 - 8. Material test reports.
 - 9. Research reports.
 - 10. Detailed comparison of Contractor's construction schedule.
 - 11. Cost information.
 - 12. Contractor's certification.
 - 13. Contractor's waiver of rights to additional payment or time.
- C. Architect's Action: If necessary, Architect will request additional information within **seven** days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection within 15 days of receipt, or seven days of receipt of additional information.

1.2 SUBSTITUTIONS

- A. Substitutions for Cause: Not later than 15 days prior to time required for submittals.
- B. Substitutions for Convenience: Not allowed, unless otherwise indicated.

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

1.1 SUMMARY

- A. Minor Changes in the Work: AIA Document G710 issued by Architect.
- B. Owner-Initiated Proposal Requests: Issued by Architect.
 - 1. Respond within time specified in Proposal Request or 20 days, when not otherwise specified.
 - 2. Quotation Form: forms acceptable to Owner and Architect.
- C. Contractor-Initiated Proposals: Submit to Architect.
 - 1. Proposal Request Form: form acceptable to Owner and Architect.
- D. Change Orders: Owner's Change Order form issued by Architect for signatures of Owner and Contractor.
- E. Construction Change Directives: Owner's CCD form included issued by Architect.

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

1.1 SUMMARY

A. Schedule of Values:

1. Format: Line items based on Project Manual table of contents and consistent with format of AIA Document G703.
2. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum.
3. Include separate line items under Contractor and principal subcontracts for LEED documentation and other project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

B. Applications for Payment:

1. Payment Application Times: Indicated in the Agreement.
2. Payment Application Forms: forms provided by Owner.
3. Waiver of Mechanic's Lien: Submitted from entities lawfully entitled to file a lien for work covered by payment for construction period covered by previous application.

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

1.1 COORDINATION DRAWINGS

- A. Prepare coordination drawings where space is limited or if required to integrate products.
- B. Coordination Digital Data Files: Same format as Drawings, operating in Microsoft Windows operating system.
 - 1. The Drawings are available in AutoCad.

1.2 REQUESTS FOR INFORMATION (RFIs)

- A. RFI Forms: Software-generated form acceptable to Owner and Architect.
- B. Architect's Action: Allow seven working days for Architect's response for each RFI.
- C. RFI Log: Maintain a tabular log of RFIs. Submit log weekly.

1.3 PROJECT WEB SITE

- A. Where applicable, use Architect's Project Web site for project communication and documentation.

1.4 PROJECT MEETINGS

- A. Architect to schedule and conduct meetings.
- B. Preconstruction conference.
- C. Preinstallation Conferences: Before each construction activity that requires coordination.
- D. Project Closeout Conference: No later than 30 days prior to the scheduled date of Substantial Completion.
- E. Progress Meetings: At weekly intervals, coordinated with preparation of payment requests.
- F. Coordination Meetings: At weekly intervals, in addition to specific meetings held for other purposes.

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

1.1 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Paper copies.
- B. Start-up construction schedule.
- C. Start-up network diagram.
- D. Contractor's construction schedule.
 - 1. Submit a working electronic copy of schedule.
- E. CPM reports.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Material Location Reports: Submit at monthly intervals.
- H. Field Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.

1.2 QUALITY ASSURANCE

- A. Scheduling Consultant: Experienced specialist in CPM scheduling and reporting.

1.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Activity Duration: No longer than 20 days.
- B. Constraints:
 - 1. Phasing.
 - 2. Work under more than one contract.
 - 3. Work by Owner.
 - 4. Products ordered in advance.
 - 5. Owner-furnished products.
 - 6. Work restrictions.
 - 7. Work stages.
 - 8. Construction areas.
- C. Milestones: Notice to Proceed, Substantial Completion, and final completion.
- D. Schedule Type: Cost- and resource-loaded CPM.
- E. Updating: At monthly intervals, issued one week before progress meeting.

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

1.1 PRODUCTS

- A. Digital Photographs: 8 megapixels.
 - 1. Prints: Two 8-by-10-inch (203-by-254-mm) matte prints.
- B. Video Recordings: Submit in digital video disc format acceptable to Owner and Architect.
- C. Preconstruction Photographs:
 - 1. 20 photographs showing existing conditions adjacent to property before starting the Work.
- D. Periodic Construction Photographs: 20 photographs monthly.
- E. Final Completion Construction Photographs: 20 color photographs.
- F. Web-Based Construction Photographic Documentation, at Contractor's option:
 - 1. Web-accessible image of current site image from fixed location camera(s), updated at 30 minute intervals.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

1.1 DEFINITIONS

- A. Action Submittals: Information that requires Architect's responsive action.
- B. Informational Submittals: Information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.2 PROCEDURES

- A. Electronic copies of CAD Drawings of the Contract Documents will not be provided by Architect for Contractor's use, unless required by Owner.
- B. Processing Time:
 - 1. Initial Review: 15 days.
 - 2. Resubmittal Review: 15 days.
 - 3. Sequential Review: 21 days.
 - 4. Concurrent Consultant Review: 15 days.
- C. Transmittal Form: AIA Document G810 or form acceptable to Owner and Architect.
- D. Submittal Procedures:
 - 1. Action Submittals: Submit minimum three paper copies.
 - 2. Informational Submittals: Submit two paper copies.
 - 3. Certificates and Certifications Submittals: Includes signature of entity responsible for preparing certification.
- E. Delegated Design Services Certification: In addition to other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional.
- F. Contractor's Review:
 - 1. Submittals: Marked with approval stamp before submitting to Architect.
- G. Architect's Action:
 - 1. Action Submittals: Stamped with an action stamp and returned.
 - 2. Informational Submittals: Reviewed but not returned, or rejected if it does not comply with requirements.
 - 3. Incomplete submittals will be returned without review.
 - 4. Submittals Not Required: May not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

1.1 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements.

1.2 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer.
 - 2. Fabricator.
 - 3. Installer.
 - 4. Professional engineer.
 - 5. Specialists.
 - 6. Testing agency.
 - 7. Manufacturer's technical representative.
 - 8. Factory-authorized service representative.
- B. Preconstruction testing.
- C. Mockups: For each form of construction and finish required, using materials indicated for the completed Work.
 - 1. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 2. Maintain mockups as a standard for judging the completed Work.
 - 3. Demolish and remove mockups when directed, unless otherwise indicated.
- D. Integrated Exterior Mockups: Construct in accordance with approved Shop Drawings.

1.3 QUALITY CONTROL

- A. Owner Responsibilities: Where indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
- B. Manufacturer's field services.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

- D. Associated Services: Access to the Work, taking and storing samples, and delivery of samples to testing agency.
- E. Special Tests and Inspections: Owner will engage a qualified testing agency and special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
- F. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections.
- G. Test and inspection log.
- H. Repair and Protection: Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

1.1 DEFINITIONS

- A. Approved.
- B. Directed.
- C. Indicated.
- D. Regulations.
- E. Furnish.
- F. Install.
- G. Provide.
- H. Project site.

1.2 INDUSTRY STANDARDS

- A. Publication Dates: In effect as of the date of the Contract Documents unless otherwise indicated.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: List included in this Section.
- B. Code Agencies: List included in this Section.
- C. Federal Government Agencies: List included in this Section.
- D. Standards and Regulations: List included in this Section.
- E. State Government Agencies: List included in this Section.

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

1.1 USE CHARGES

- A. Sewer Service: Pay charges.
- B. Water Service: Pay charges.
- C. Electric Power Service: Pay charges.

1.2 INFORMATIONAL SUBMITTALS

- A. Erosion- and sedimentation-control plan.
- B. Moisture-protection plan.
- C. Dust-control and HVAC-control plan.

1.3 MATERIALS

- A. Portable chain-link fencing.

1.4 TEMPORARY FACILITIES

- A. Common-Use Field Office: Prefabricated or mobile units, including conference room.
- B. Storage and fabrication sheds.

1.5 EQUIPMENT

- A. Fire extinguishers.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained heaters with individual space thermostatic control.
 - 1. Permanent HVAC System: If Owner authorizes use of HVAC system, provide filter with MERV of 8 at each return air grille and clean HVAC system.
- C. Air Filtration Units: HEPA filter-equipped portable units. Configure to run continuously.

1.6 TEMPORARY UTILITY INSTALLATION

- A. Sewers and drainage.
- B. Water service: Connect to existing service.

- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water.
 - 1. Toilets: Use of existing facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities.
- E. Isolation of work areas in occupied facilities.
- F. Ventilation and humidity control.
- G. Electric Power Service: Provide temporary overhead service.
- H. Lighting: Provide temporary lighting.
- I. Telephone Service: Provide temporary telephone service in common-use facilities.
- J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications.

1.7 SUPPORT FACILITIES INSTALLATION

- A. Temporary Roads and Paved Areas: Locate temporary roads and paved areas where indicated within construction limits indicated on Drawings.
- B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas.
- C. Parking: Provide temporary construction use parking areas or use designated areas of Owner's existing parking areas.
- D. Dewatering Facilities and Drains: Maintain Project site, excavations, and construction free of water.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
- F. Temporary Elevator Use: Not permitted.

1.8 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Temporary erosion and sedimentation control.
- B. Stormwater control.
- C. Tree and plant protection.
- D. Covered Walkway, where indicated: Erect protective, covered walkway for passage of individuals through or adjacent to Project site.

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

END OF SECTION 015000

SECTION 01 6000 - PRODUCT REQUIREMENTS

1.1 ACTION SUBMITTALS

- A. Comparable Product Requests: Architect will notify Contractor of approval or rejection within 15 days of receipt of request, or seven days of receipt of additional information.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Use means and methods that will prevent damage, deterioration, and loss, including theft.
- B. Store products to allow for inspection and measurement or counting of units.
- C. Provide for storage of materials and equipment by Owner.

1.3 PRODUCT WARRANTIES

- A. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1.4 PRODUCT SELECTION PROCEDURES

- A. Product Selection Procedures:
 - 1. Product: Product named that complies with requirements.
 - 2. Manufacturer/Source: Product by manufacturer or from source named that complies with requirements.
 - 3. Products: One of the products listed that complies with requirements. Comparable products will not be considered, unless otherwise indicated.
 - 4. Manufacturers: Product by one of the manufacturers listed that complies with requirements. Comparable products will not be considered, unless otherwise indicated.
 - 5. Basis-of-Design Product: Either the specified product or a comparable product by one of the other named manufacturers.
 - 6. Visual Matching Specification: Product that matches Architect's sample. Architect's decision will be final.
 - 7. Visual Selection Specification: Product (and manufacturer) that complies with other specified requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

1.5 COMPARABLE PRODUCTS

- A. Conditions for Consideration:

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

1. Product does not require revisions to the Contract Documents, is consistent with the Contract Documents and will produce the indicated results, and is compatible with other portions of the Work.
2. Comparison of proposed product with those named in the Specifications.
3. Product provides specified warranty.
4. Similar installations, if requested.
5. Samples, if requested.

END OF SECTION 016000

SECTION 017300 - EXECUTION

1.1 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Certificates: Signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and patching plan.
- D. Certified Surveys: Signed by land surveyor or professional engineer.
- E. Final property survey.

1.2 EXECUTION

- A. Existing Conditions: Existence and location of site improvements, utilities, and other construction affecting the Work must be investigated and verified.
- B. Review of Contract Documents and field conditions.
- C. Construction Layout: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
- D. Field Engineering: Owner will identify existing benchmarks, control points, and property corners. Locate existing permanent benchmarks, control points, and similar reference points.
 - 1. Benchmarks: Establish two permanent benchmarks on Project site.
 - 2. Certified survey of construction and sitework.
 - 3. Final property survey.
- E. Installation: Comply with manufacturer's written instructions.

1.3 CUTTING AND PATCHING

- A. Provide temporary support.
- B. Protect in-place construction.
- C. Protect adjacent occupied areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Minimize interruption to occupied areas.
- E. Cutting: In general, use hand or small power tools. Cut holes and slots neatly to minimum size required. Temporarily cover openings when not in use.

- F. Patching: Patch with durable seams that are as invisible as practicable. Restore exposed finishes.

1.4 OWNER-INSTALLED PRODUCTS

- A. Provide access to Project site for Owner's personnel.
- B. Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable.
- C. Include Owner's personnel at preinstallation conferences.

1.5 PROGRESS CLEANING

- A. Clean Project site and work areas daily. Dispose of materials lawfully.
- B. Keep installed work clean.
- C. Remove debris from concealed spaces.

1.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation.
- B. Adjust equipment for proper operation.

1.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure Work is without damage.

1.8 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces if not repaired without visible evidence of repair.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.1 SUMMARY

- A. Salvaging nonhazardous construction waste.
- B. Recycling nonhazardous construction waste.
- C. Disposing of nonhazardous construction waste.

1.2 PERFORMANCE REQUIREMENTS

- A. End-of-Project Rates for Salvage/Recycling: 50 percent.

1.3 WASTE MANAGEMENT PLAN

- A. Types and quantities of site-clearing and construction waste.
- B. Type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator.
- C. Net additional cost or net savings resulting from waste management plan.

1.4 PLAN IMPLEMENTATION

- A. Engage a waste management coordinator.
- B. Train workers, subcontractors, and suppliers on proper waste management procedures.
- C. Recycling Incentives: Revenues and other incentives for recycling will accrue to Owner.

END OF SECTION 017419

SECTION 01 7700 - CLOSEOUT PROCEDURES

1.1 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection, complete the following.

1. List of incomplete items (punch list).
 - a. Submit PDF electronic file.
 - b. Submit Three paper copies, unless otherwise indicated. Architect, will return two copies.
2. Owner advised of pending insurance changeover.
3. Warranties, maintenance service agreements, and similar documents submitted.
4. Releases, occupancy permits, and operating certificates submitted.
5. Project Record Documents submitted.
6. Tools, spare parts, and extra materials delivered.
7. Final changeover of locks performed.
8. Startup testing completed.
9. Test/adjust/balance records submitted.
10. Temporary facilities removed.
11. Owner advised of heat and utility changeover.
12. Changeover information for use, operation, and maintenance submitted.
13. Final cleaning performed.
14. Touchup performed.

1.2 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection, complete the following:

1. Final Application for Payment submitted.
2. List of incomplete items (punch list) endorsed by Architect as completed or otherwise resolved for acceptance.
3. Evidence of continuing insurance coverage submitted.
4. Final pest-control inspection report and warranty submitted.
5. Owner's personnel instructed in operation, adjustment, and maintenance of equipment and systems, including demonstration and training videotapes submitted.

1.3 WARRANTIES

- A. Partial Occupancy: Submit warranties within 15 days of completion of designated portions of the Work that are occupied or used by Owner.
- B. Organize warranty documents based on the Project Manual and bind in heavy-duty, three-ring, vinyl-covered, loose-leaf binders.
- C. Scan warranties and bonds into a single indexed electronic PDF file.

1.4 FINAL CLEANING

- A. Each surface or unit cleaned to condition expected in an average commercial building cleaning and maintenance program.
- B. Replace disposable air filters and clean permanent air filters.
- C. Clean ducts, blowers, and coils if units were operated without filters during construction.
- D. Clean HVAC system in compliance with NADCA Standard 1992-01.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

1.1 SUMMARY

- A. Emergency, operation and maintenance manuals.

1.2 PRODUCTS

- A. Format:
 - 1. PDF electronic files with composite electronic index on digital media acceptable to Architect. Include a complete electronically-linked operation and maintenance directory.
 - 2. Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, one set(s) of copies.
- B. Emergency Manuals: Types of emergencies, emergency instructions, and emergency procedures.
- C. Operation Manuals: System, subsystem, and equipment descriptions, operating procedures, wiring diagrams, control diagrams and sequence of operation, and piped system diagrams.
- D. Product Maintenance Manuals: Source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds.
- E. Systems and Equipment Maintenance Manuals: Source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

1.1 PRODUCTS

- A. Record Drawings:
 - 1. One set of marked-up record prints.
- B. Record Specifications: One paper copy of marked-up record specifications.
- C. Record Product Data: One paper copy and annotated PDF electronic files and directories.
- D. Miscellaneous Record Submittals: One paper copy and annotated PDF electronic files and directories.

1.2 PRODUCTS

- A. Record Prints by Architect: One set of paper copies of Contract Documents and Shop Drawings, marked to show actual installation.
- B. Record Digital Data Files by Architect: Corrected digital data files of the Contract Drawings, as follows:
 - 1. Format: Same as the original Contract Drawings.
 - 2. Format: DWG and PDF, Version, operating in AutoCad and Microsoft Word operating systems.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

1.1 INSTRUCTION PROGRAM

- A. Program Structure: Training modules for each system and for equipment not part of a system, including the following:
 - 1. Basis of system design, operational requirements, and criteria.
 - 2. Documentation.
 - 3. Emergencies.
 - 4. Operations.
 - 5. Adjustments.
 - 6. Troubleshooting.
 - 7. Maintenance.
 - 8. Repairs.
- B. Facilitator to prepare instruction program and training modules and to coordinate instructors.
- C. Evaluation: Demonstration performance-based test.

1.2 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. Commercial videographer to record demonstration and training video recordings.
- B. Narration: Describe scenes on video recording and provide a transcript of the narration.
- C. Provide video recordings used as a component of training modules.

END OF SECTION 017900

SECTION 018113 - SUSTAINABLE DESIGN REQUIREMENTS

1.1 SUMMARY

- A. LEED - Silver certification based on LEED-NC, Version 2.2.

1.2 SUBMITTALS

- A. Project Materials Cost Data: For building materials used for Project, excluding mechanical, electrical, and plumbing components, and specialty items such as elevators and equipment.
 - 1. For wood-based materials used for Project.
- B. LEED Action Plans: Submit within 30 days of date established for the Notice to Proceed:
 - 1. Credit MR 2.1 and Credit MR 2.2: Waste management plan.
 - 2. Credit MR 3.1 and Credit MR 3.2: Salvaged and refurbished materials.
 - 3. Credit MR 4.1 and Credit MR 4.2: Materials with recycled content.
 - 4. Credit MR 5.1 and Credit MR 5.2: Regional materials.
 - 5. Credit MR 5.1 and Credit MR 5.2: Regionally manufactured materials and regionally extracted and manufactured materials.
 - 6. Credit MR 7: Certified wood products.
 - 7. Credit EQ 3.1: Construction indoor-air-quality management plan.
- C. LEED Progress Reports: With each Application for Payment, comparing construction and purchasing with LEED action plans.
- D. LEED Documentation Submittals: Product data, receipts, certification letters, chain-of-custody certificates, and other documentation needed to show compliance with requirements.

1.3 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional.

1.4 PRODUCTS

- A. Contractor selects materials to comply with the following:
 - 1. Credit MR 4.1 and Credit MR 4.2: Post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of cost of materials.
 - 2. Credit MR 5.1 and Credit MR 5.2: 20 percent regional materials.
 - 3. Credit MR 5.1: 20 percent regionally manufactured materials.
 - 4. Credit MR 5.2: 10 percent regionally extracted and manufactured materials.
 - 5. Credit MR 7: 50 percent of wood-based materials are FSC certified.

1.5 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. Credit EQ 3.1: "SMACNA IAQ Guideline for Occupied Buildings under Construction."
- B. Credit EQ 3.2: Indoor air flush-out.

1.6 LEED CHECKLIST

END OF SECTION 018113

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FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION

MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A x B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

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FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN

MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

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FORM CWM-5: COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION WORK PLAN

MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

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FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT

MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

1.1 SUMMARY

A. Commissioning Team:

1. Members representing each contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists.
2. Members representing Owner, including CxA, facility user and operation and maintenance personnel, and Architect and engineering design professionals.

B. Owner's Responsibilities:

1. Provide OPR and BoD documentation.
2. Assign operation and maintenance personnel and schedule them for commissioning activities.

C. Contractor's Responsibilities: Assign personnel and schedule them for commissioning activities.

D. CxA's Responsibilities:

1. Organize and lead commissioning team.
2. Provide commissioning plan.
3. Convene commissioning team meetings.
4. Provide Project-specific checklists and test procedures.
5. Verify the execution of commissioning process activities using random sampling.
6. Prepare and maintain Issues Log.
7. Prepare and maintain completed construction checklist log.
8. Witness systems, assemblies, equipment, and component startup.
9. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

END OF SECTION 019113

SECTION 033000 - CAST-IN-PLACE CONCRETE

1.1 SUMMARY

- A. Cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.

1.2 QUALITY ASSURANCE

- A. Quality Standard: ACI 301.
- B. Mockups to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1.3 MATERIALS

- A. Form-facing materials.
- B. Steel Reinforcement:
 - 1. Reinforcing Bars: Deformed.
 - 2. Welded Wire Reinforcement: Plain.
- C. Concrete Materials:
 - 1. Portland Cement: ASTM C 150, Type V, gray, supplemented with fly ash.
 - 2. Silica fume.
 - 3. Aggregate: Normal weight.
 - 4. Water: Potable.
 - 5. Admixtures: Air entraining, High range, water reducing and retarding, Plasticizing and retarding.
- D. Fiber Reinforcement: Synthetic, polypropylene.
- E. Vapor Retarders: Class A Polyethylene, 10-mil- (0.25-mm-) thick sheet.
 - 1. Granular Course over Vapor Retarder: Granular fill.
- F. Floor and Slab Treatments: Penetrating liquid floor treatment.
- G. Curing Materials: Clear, waterborne, membrane-forming curing, dissipating compound.
- H. Related Materials: Expansion- and isolation-joint-filler strips, Semirigid joint filler.

- I. Repair Materials: Underlayment.

1.4 CONCRETE MIXTURES

- A. Compressive Strength (28 Days):
 - 1. Footings: 3000 psi (20.7 MPa).
 - 2. Foundation Walls: 4000 psi (27.6 MPa).
 - 3. Interior Slabs-on-Grade: 3000 psi (20.7 MPa).
 - 4. Mixing: Ready mixed.

1.5 INSTALLATION

- A. Formed-Surface Finish: Rough for unexposed concrete, Smooth for exposed.
- B. Floor and Slab Finishes:
 - 1. Float: Surfaces to receive trowel finish.
 - 2. Trowel: Surfaces exposed to view, and surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane.
 - 3. Broom: Exterior concrete platforms, steps, ramps.

1.6 FIELD QUALITY CONTROL

- A. Testing: By Owner engaged agency.
- B. Inspections: By Owner engaged special inspector.

END OF SECTION 033000

SECTION 033300 - ARCHITECTURAL CONCRETE

1.1 SUMMARY

- A. Cast-in-place architectural concrete including form-facing materials, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes.

1.2 QUALITY ASSURANCE

- A. Quality Standards: ACI 301 and ACI 303.1.
- B. Field samples for each finish, color, and texture variation.
- C. Mockups to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1.3 MATERIALS

- A. Form-Facing Materials: Nonabsorptive form-facing panels, chamfer strips, and form ties.
- B. Bar supports.
- C. Concrete Materials:
 - 1. Portland Cement: ASTM C 150, Type I/II, gray, supplemented with fly ash.
 - 2. Aggregate: Normal weight, gap graded.
 - 3. Water.
 - 4. Admixtures: Air entraining, Water reducing, Plasticizing and retarding.
 - 5. Color pigment.
- D. Curing Materials: Waterborne, membrane-forming curing compound.

1.4 CONCRETE MIXTURES

- A. Compressive Strength (28 Days): 4000 psi (27.6 MPa), ready mixed.

1.5 INSTALLATION

- A. As-Cast Formed Finish: Smooth formed.

END OF SECTION 033300

SECTION 042000 - UNIT MASONRY

1.1 PERFORMANCE REQUIREMENTS

- A. Net-Area Compressive Strengths of Structural Unit Masonry: As indicated.
- B. Determine net-area compressive strength of masonry by unit-strength method.

1.2 QUALITY ASSURANCE

- A. Preconstruction Testing: Owner engaged.
- B. Mockups of typical wall areas.

1.3 MATERIALS

- A. Concrete Masonry Units (CMUs):
 - 1. Manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted and manufactured within 500 miles (800 km) of Project site.
 - 2. Units made with integral water repellent for exposed units and where indicated.
 - 3. CMUs: Lightweight.
 - 4. Decorative CMUs: Lightweight units with ground-face finish.
- B. Masonry Lintels: Built-in-place CMU lintels.
- C. Brick: Face brick.
 - 1. Manufactured within 500 miles (800 km) of Project site from materials that have been extracted within 500 miles (800 km) of Project site.
- D. Reinforcement: Uncoated steel reinforcing bars.
- E. Masonry Joint Reinforcement:
 - 1. Interior Walls: Mill-galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
- F. Ties and Anchors: Galvanized steel. Mill galvanized in interior walls.
 - 1. Adjustable Masonry-Veneer Anchors: Screw attached, slip in and seismic.
- G. Embedded Flashing:
 - 1. Partially Exposed Flashing: Stainless steel.
 - 2. Concealed (Flexible) Flashing: elastomeric thermoplastic or EPDM.
 - a. Used with stainless steel drip edge.

- H. Weep/Vent Holes: Wicking material.
- I. Cavity drainage material.
- J. Reinforcing bar positioners.
- K. Masonry-Cell Insulation: Loose-granular perlite or molded-polystyrene units.
- L. Cavity-Wall Insulation: Extruded-polystyrene board.
- M. Mortar:
 - 1. Aggregates, cement, and lime that have been extracted and manufactured within 500 miles (800 km) of Project site.

1.4 INSTALLATION

- A. Match existing masonry coursing, bonding, color, and texture, unless otherwise indicated.
- B. Bond Pattern: Running-bond.

1.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner engaged.
- B. Inspections: Level 2 special inspections according to the "International Building Code."
- C. Testing: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

1.1 SUMMARY

- A. Structural steel as classified by AISC 303.
- B. Prefabricated building columns.
- C. Grout.

1.2 PERFORMANCE REQUIREMENTS

- A. Fabricator to select or complete simple shear connections, to withstand design loads.

1.3 QUALITY ASSURANCE

- A. Quality Standards: AISC 303, AISC 341, AISC 341s1, and AISC 360.

1.4 MATERIALS

- A. Recycled Content of Steel: Postconsumer plus one-half of preconsumer recycled content not less than 25 percent.
 - 1. W-Shapes: 60 percent.
 - 2. Channels, Angles, M-Shapes: 60 percent.
 - 3. Plate and Bar: 25 percent.
 - 4. Cold-Formed Hollow Structural Sections: 25 percent.
 - 5. Steel Pipe: 25 percent.
 - 6. All Other Steel Materials: 25 percent.
- B. Structural-Steel Shapes: W-shapes, channels, angles, M-shapes, plate and bar, cold-formed hollow structural sections.
- C. Steel castings.
- D. Steel forgings.
- E. Bolts, Nuts, and Washers: High strength.
- F. Anchor Rods: Unheaded and Headed rods, nuts, plate washers, and washers.
- G. Connectors: Shear connectors.
- H. Primer: Zinc oxide or Latex where required by Division 09 Painting Sections for exposed steel, or Fabricator's standard, non-asphaltic for un-exposed steel.
- I. Grout: Nonmetallic, shrinkage resistant.

1.5 FABRICATION

- A. Shop Connections:
 - 1. High-Strength Bolts: Snug tightened.
 - 2. Welded connections.
- B. Surface Preparation: SSPC-SP 3, or as required by Division 09 Painting Sections.
- C. Galvanizing: Hot dip.

1.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner engaged.

1.7 INSTALLATION

- A. Field Connections:
 - 1. High-Strength Bolts: Snug tightened.
 - 2. Welded connections.

1.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner engaged.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

1.1 SUMMARY

- A. Open-web K-series steel joists.
- B. K-series steel joist substitutes.
- C. LH-series long-span steel joists.
- D. Joist accessories, including permanent bridging.

1.2 MATERIALS

- A. Bolts: High-strength carbon steel.
 - 1. Finish: Plain, uncoated.
- B. Primer: SSPC-Paint 15.
- C. Open-Web K-Series Steel Joists: With extended ends where indicated.
- D. Long-Span Steel Joists:
 - 1. End Arrangement: Square.
 - 2. Top-Chord Arrangement: Parallel.

1.3 INSTALLATION

- A. Connections: Welded, Bolted.

1.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage testing agency to inspect field welds and bolted connections.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

1.1 SUMMARY

- A. Roof deck.
- B. Composite floor deck.

1.2 QUALITY ASSURANCE

- A. FMG Listing: Steel roof deck.

1.3 MATERIALS

- A. Roof Deck: Galvanized and shop-primed steel sheet.
 - 1. Profile Depth: 1-1/2 inches (38 mm).
- B. Composite Floor Deck: Galvanized and shop-primed steel sheet.
 - 1. Profile Depth: 2 inches (51 mm).
- C. Accessories: pour stops, recessed sump pans.

1.4 INSTALLATION

- A. Roof Deck: Welded.
- B. Floor Deck: Welded.

1.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner engaged.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

1.1 SUMMARY

- A. Exterior load-bearing wall framing, where indicated.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Dead Loads: As indicated on Drawings.
 - 2. Live Loads: As indicated on Drawings.
 - 3. Roof Loads: As indicated on Drawings.
 - 4. Snow Loads: As indicated on Drawings.
 - 5. Wind Loads: As indicated on Drawings.
 - 6. Seismic Loads: As indicated on Drawings.
 - 7. Deflection Limits: As indicated on Drawings.
- B. Engineering design of cold-formed metal framing by Contractor, as deferred submittal.

1.3 QUALITY ASSURANCE

- A. Design Standard: AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1.4 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, metallic coated.
- B. Load-Bearing Wall Framing: Standard C-shaped, punched steel studs, steel box or back-to-back headers, and U-shaped, unpunched track.
 - 1. Minimum Steel Thickness: 0.0538 inch (1.37 mm), unless otherwise indicated.
- C. Exterior Non-Load-Bearing Wall Framing: Standard C-shaped, punched steel studs and U-shaped, unpunched track.
 - 1. Minimum Steel Thickness: 0.0538 inch (1.37 mm), unless otherwise indicated.
 - 2. Vertical deflection clips, Double deflection track, Drift clips.
- D. Framing Accessories: Supplementary framing, bracing, bridging, and solid blocking, gusset plates, stud kickers and girts and joist hangers and end closures.
- E. Insulation for inaccessible voids.

1.5 INSTALLATION

A. Fasten framing by welding or screw fastening.

1. Load-Bearing Wall Stud Spacing: 16 inches (406 mm).

1.6 FIELD QUALITY CONTROL

A. Testing: By Owner-engaged agency.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

1.1 SUMMARY

- A. Miscellaneous metal framing and supports.
- B. Loose metal plates and shapes.
- C. Miscellaneous fabricated metal items.

1.2 PRODUCTS

- A. Materials: Steel plates, shapes, and bars, Steel tubing, Steel pipe, Slotted channel framing.
- B. Miscellaneous Framing and Supports:
 - 1. Steel framing and supports for countertops, mechanical and electrical equipment, applications where framing and supports are not specified in other Sections.
 - 2. Galvanize where indicated.
 - 3. Prime with zinc-rich primer where indicated.
- C. Loose steel lintels, galvanized at exterior walls, primed with zinc-rich primer at interior.
- D. Shelf angles, galvanized.
- E. Loose bearing and leveling plates, galvanized at exterior, primed with zinc-rich primer at interior.
- F. Steel weld plates and angles not specified in other Sections, for casting into concrete.
- G. Metal Bollards: Schedule 40 steel pipe where indicated.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

1.1 SUMMARY

- A. Preassembled steel stairs with concrete-filled treads.
- B. Steel tube railings attached to metal stairs.
- C. Steel tube handrails attached to walls adjacent to metal stairs.
- D. Railing gates at the level of exit discharge.

1.2 PERFORMANCE REQUIREMENTS

- A. Engineering design of steel stairs and railings by Contractor.

1.3 QUALITY ASSURANCE

- A. Stair Standard: NAAMM AMP 510, "Metal Stairs Manual."
 - 1. Preassembled Stairs: Commercial class.

1.4 MATERIALS

- A. Stringers: Steel tubes.
- B. Metal-Pan Stairs: Uncoated cold-rolled steel sheet.
- C. Steel Tube Railings:
 - 1. Rails and Posts: 1-1/2-inch- (38-mm-) top and bottom rails and 1-1/2-inch- (38-mm-) square posts.
 - 2. Picket Infill: Indicated pickets spaced less than 4 inches (100 mm) clear.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

1.1 SUMMARY

- A. Steel pipe and tube railings.
- B. Stainless-steel pipe and tube railings, Type 304.

1.2 PERFORMANCE REQUIREMENTS

- A. Engineering design of railings by Contractor.

1.3 FABRICATION

- A. Changes in Direction of Members: By bending or by inserting prefabricated fittings.
- B. Connections: Welded.
- C. Toe boards.

1.4 FINISHES

- A. Steel and Iron: Primed with zinc-rich primer compatible with Division 09 Section High-performance Coatings.
- B. Stainless Steel: Directional satin, No. 4.

END OF SECTION 055213

SECTION 061050 - MISCELLANEOUS CARPENTRY

1.1 SUMMARY

- A. Wood blocking and nailers.
- B. Plywood backing panels.

1.2 QUALITY ASSURANCE

- A. Forest certification by an FSC-accredited certification body for the following:
 - 1. Miscellaneous lumber.

1.3 MATERIALS

- A. Wood-Preservative-Treated Materials, where indicated:
 - 1. Preservative Treatment: AWPA C2 with chemicals containing no arsenic or chromium.
 - a. AWPA C31 (inorganic boron) may be used in protected locations.
 - 2. Application: Items indicated and the following:
 - a. Items in contact with roofing or waterproofing.
 - b. Items in contact with concrete or masonry.
 - c. Framing less than 18 inches (460 mm) above ground in crawlspaces.
 - d. Floor plates installed over concrete slabs-on-grade.
- B. Fire-Retardant-Treated Materials, where indicated:
 - 1. Exterior type for exterior locations and where indicated.
 - 2. Interior Type A, High Temperature (HT) for enclosed roof framing, and where indicated.
 - 3. Interior Type A, unless otherwise indicated.
 - 4. Application: All miscellaneous carpentry, including:
 - a. Concealed blocking.
 - b. Roof construction.
 - c. Plywood backing panels.
- C. Dimension Lumber Framing:
 - 1. Maximum Moisture Content: 15 percent.
 - 2. Other Framing: Construction, Stud, or No. 3 grade Douglas fir-larch, or hem-fir.
- D. Plywood backing panels for telephone and electrical equipment.
- E. Fasteners: Hot-dip galvanized steel where exposed to weather, in ground contact, in contact with treated wood, or in area of high relative humidity.

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Ogden, Utah

F. Metal Framing Anchors:

1. Metal: Hot-dip galvanized steel.

END OF SECTION 061050

SECTION 064020 - INTERIOR ARCHITECTURAL WOODWORK

1.1 SUMMARY

- A. Interior standing and running trim.
- B. Interior frames and jambs.
- C. Flush wood paneling.
- D. Wood and plastic-laminate cabinets.
- E. Plastic-laminate and solid-surfacing-material countertops.
- F. Laminated-plastic laboratory tops.
- G. Closet and utility shelving.

1.2 QUALITY ASSURANCE

- A. Quality Standard: AWI including installation.

1.3 MATERIALS

- A. Composite Wood Products: Made without urea formaldehyde.
- B. Interior Woodwork Grade: Premium.
- C. Wood Species and Cut for Transparent Finish: Cherry, plain sawn or sliced.
- D. Interior Standing and Running Trim for Transparent Finish:
 - 1. Grade: Premium.
 - 2. Wood Species and Cut: Match other woodwork in same area of building.
- E. Flush Wood Paneling:
 - 1. Grade: Premium.
 - 2. Wood Species and Cut: Cherry, plain sliced.
 - 3. Veneer Matching: Book match veneer leaves and center-balance match within panel face.
 - 4. Panel-Matching Method:
 - a. Sequence-matched, uniform-size sets.
 - 5. Flame-Spread Index: 75 or less.
- F. Wood Cabinets for Transparent Finish:

1. Grade: Premium.
 2. AWI Type of Cabinet Construction: Flush overlay.
 3. Wood Species and Cut for Exposed Surfaces: Cherry, plain sawn or cut.
 - a. Veneer Matching: Book match veneer leaves and center-balance match within panel face.
 - 1) Cabinet veneers in each space from a single flitch.
 4. Cabinet Interior: Thermoset decorative panels.
- G. Solid-Surfacing-Material Countertops:
1. Grade: Premium.
 2. Thickness: 3/4 inch (19 mm).
- H. Laminated-Plastic Laboratory Tops: Premium with chemical-resistant laminate.
- I. Plastic-Laminate Countertops:
1. Grade: Premium
 2. Edge Treatment: Self-edged.
- J. Cabinet Hardware:
1. Hinges: Frameless, concealed.
 2. Pulls: Wire.
 3. Locks: Door and drawer.
 4. Exposed Hardware Finishes: Satin stainless steel.
- K. Closet and Utility Shelving: Premium grade.
- L. Shop Finishing:
1. Grade: Same grade as woodwork.
 2. Extent: All woodwork shop finished.

END OF SECTION 064020

SECTION 066400 - PLASTIC PANELING

1.1 QUALITY ASSURANCE

- A. Flame-Spread Index: 25 or less.

1.2 PRODUCTS

- A. Plastic Sheet Paneling: Gelcoat-finished, glass-fiber reinforced plastic panels.
 - 1. Surface Finish: Smooth.
 - 2. Color: White.
- B. Trim Accessories: Vinyl extrusions.
 - 1. Color: White.
- C. Adhesive: As recommended by paneling manufacturer.
 - 1. VOC Limit: 50 g/L.
- D. Sealant: Mildew-resistant, neutral-curing silicone.
 - 1. VOC Limit: 250 g/L.

1.3 INSTALLATION

- A. Installation Method: Adhesive.
 - 1. Fill grooves in trim accessories with sealant.
 - 2. Maintain uniform space between panels and fill space with sealant.

END OF SECTION 066400

SECTION 071113 - BITUMINOUS DAMPPROOFING

1.1 SUMMARY

- A. Cold-applied, emulsified-asphalt dampproofing applied to the following surfaces:
 - 1. Exterior, below-grade surfaces of concrete and masonry foundation walls.
 - 2. Back side of concrete retaining walls, below grade.

1.2 MATERIALS

- A. Protection Course: Polystyrene.

1.3 INSTALLATION

- A. Cold-Applied, Emulsified-Asphalt Dampproofing:
 - 1. Concrete Foundations: Two brush or spray coats, one fibered brush or spray coat, or one trowel coat.
 - 2. Unparged Masonry Foundation Walls: Primer and two brush or spray coats, primer and one fibered brush or spray coat, or primer and one trowel coat.

END OF SECTION 071113

SECTION 072100 - BUILDING INSULATION

1.1 SUMMARY

A. Applications:

1. Concealed building insulation.
2. Vapor retarders.
3. Sound attenuation insulation.

1.2 PERFORMANCE REQUIREMENTS

- #### A. Plenum Rating:
- Glass or Slag-wool-fiber/rock-wool-fiber insulation rated for resistance against erosion and mold growth per UL 181.

1.3 MATERIALS

A. Insulation:

1. Foil-Faced Polyisocyanurate Board: Type I, Class 1 or 2.
2. Faced Glass-Fiber Blanket: Type III, Class A; Category 1, faced with foil-scrim-kraft, vapor-retarder membrane on 1 face.
3. Faced Slag-Wool-Fiber/Rock-Wool-Fiber Blanket: Type III, Class A; Category 1, faced with foil-scrim-kraft, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.

- #### B. Vapor Retarders:
- Fire-retardant, reinforced polyethylene.

C. Auxiliary Insulating Materials:

1. Insulation fasteners.

END OF SECTION 072100

SECTION 074113 - METAL ROOF PANELS

1.1 SUMMARY

- A. Factory-formed and field-assembled, standing-seam panels.

1.2 PERFORMANCE REQUIREMENTS

- A. Air Infiltration: ASTM E 1680.
- B. Water Penetration: ASTM E 1646.
- C. Hydrostatic-Head Resistance: ASTM E 2140.
- D. Wind-Uplift Resistance: UL 580.
 - 1. Uplift Rating: UL 90.
- E. FMG listed.
 - 1. Fire/Windstorm Classification: Class 1A-105.
 - 2. Hail Resistance: MH.
- F. Structural Performance: ASTM E 1592.
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Snow Loads: As indicated on Drawings.
 - 3. Deflection Limits: 1/240.
- G. Solar Reflectivity/Emissivity: LEED.

1.3 QUALITY ASSURANCE

- A. Mockups for each form of construction.

1.4 WARRANTY

- A. Materials and Workmanship: Two years.
- B. Finishes: 20 years.
- C. Weathertightness for Standing-Seam Metal Roof Panels: 20 years.

1.5 MATERIALS

- A. Polyethylene vapor retarder.

- B. Self-adhering, high-temperature sheet underlayment.
- C. Felt underlayment.
- D. Slip sheet.
- E. Substrate Boards: Glass-mat gypsum sheathing board.
- F. Miscellaneous Metal Framing: Cold-rolled furring channels and Z-shaped furring.

1.6 PRODUCTS

- A. Standing-Seam Metal Roof Panels:
 - 1. Profile: Vertical rib, seamed joint.
 - 2. Material: Aluminum-zinc alloy-coated steel sheet.
 - 3. Exterior Finish: 3-coat fluoropolymer.
- B. Accessories, where indicated:
 - 1. Flashing and trim.
 - 2. Gutters.
 - 3. Downspouts.
 - 4. Roof curbs.
 - 5. Snow Guards: Seam-mounted, bar type.
 - 6. Pipe flashing.

1.7 FIELD QUALITY CONTROL

- A. Testing: By Owner-engaged agency.

END OF SECTION 074113

SECTION 074213 - METAL WALL PANELS

1.1 SUMMARY

- A. Factory-formed and field-assembled concealed-fastener, lap-seam metal wall and metal soffit panels.

1.2 PERFORMANCE REQUIREMENTS

- A. Air Infiltration: ASTM E 283.
- B. Water Penetration under Static Pressure: ASTM E 331.
- C. Water Penetration under Dynamic Pressure: AAMA 501.1.
- D. Structural Performance: ASTM E 1592.
 - 1. Wind Loads: As indicated on Drawings).
 - 2. Deflection Limits: AS indicated on Drawings.

1.3 QUALITY ASSURANCE

- A. Mockups for each form of construction.

1.4 WARRANTY

- A. Materials and Workmanship: Two years.
- B. Finishes: 20 years.

1.5 MATERIALS

- A. Miscellaneous Metal Framing: base or sill angles or channels.

1.6 PRODUCTS

- A. Concealed-Fastener, Lap-Seam Metal Wall Panels:
 - 1. Profile: Tapered rib.
 - 2. Material: Zinc-coated (galvanized) steel sheet.
 - 3. Exterior Finish: 3-coat fluoropolymer.
- B. Accessories: Flashing and trim.

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Ogden, Utah

1.7 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency.

END OF SECTION 074213

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

1.1 SUMMARY

- A. Mechanically fastened TPO membrane roofing system.
- B. Vapor retarder.
- C. Roof insulation.

1.2 PERFORMANCE REQUIREMENTS

- A. Roofing System Design: Uplift pressures calculated according to ASCE/SEI 7.
- B. FM Approvals Listing: Class 1A-105.
- C. Cool Roof Performance: LEED - low slope.

1.3 QUALITY ASSURANCE

- A. Exterior Fire-Test Exposure: Class A.
- B. Preliminary roofing and preinstallation conference.

1.4 WARRANTY

- A. Manufacturer's Materials and Workmanship Warranty: 15 years.
- B. Installer's Warranty: Two years.

1.5 MATERIALS

- A. TPO Membrane Roofing: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible fabric backed TPO sheet.
 - 1. Thickness: 60 mils (1.5 mm), nominal.
 - 2. Color: White.
- B. Low VOC adhesives and sealants for LEED.
- C. Sheet Flashing: Same as TPO sheet membrane.
- D. Substrate Board: Glass-mat, water-resistant gypsum or Cellulosic-fiber-reinforced, water-resistant gypsum board.
- E. Vapor Retarder: Polyethylene film.

F. Roof Insulation: Polyisocyanurate board.

1. Tapered Boards: 1/4 inch per 12 inches (1:48).

G. Cover Board: Glass-mat, water-resistant gypsum substrate or Cellulosic-fiber-reinforced, water-resistant gypsum substrate.

H. Walkways: Rolls.

1.6 INSTALLATION

A. Roof Insulation: Mechanically fastened.

B. Membrane Roofing: Mechanically fastened.

1.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner engaged.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

1.1 SUMMARY

A. Formed Roof Flashing and Trim where not furnished by other Sections:

1. Roof edge flashing and fascia caps.
2. Copings.
3. Base flashing.
4. Counterflashing.
5. Flashing receivers.
6. Roof-penetration flashing.
7. Splash pans.
8. Roof-drain flashing.

B. Miscellaneous Formed Flashing:

1. Formed equipment support flashing.

1.2 PERFORMANCE REQUIREMENTS

- #### A. Roof Edge Flashing and Copings:
- Capable of resisting Wind Zone 1 forces according to FMG Loss Prevention Data Sheet 1-90.

1.3 QUALITY ASSURANCE

- #### A. Quality Standard:
- SMACNA's "Architectural Sheet Metal Manual."
- #### B. Mockup of typical roof eave.

1.4 MATERIALS

A. Sheet Metals for Flashing and Trim:

1. Prepainted, Metallic-Coated Steel: High-performance organic, where exposed.
2. Galvanized steel elsewhere.

B. Underlayment: Polyethylene sheet.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

1.1 WARRANTY

- A. Painted Finishes: 20 years.

1.2 PRODUCTS

- A. Roof Hatches: Insulated with double-walled curbs.
 - 1. Height: Minimum 12 inches (300 mm).
 - 2. Hatch Lid: Opaque.
 - 3. Material: Aluminum-zinc alloy-coated steel.
 - 4. Finish: Baked enamel or powder coat.
 - 5. Accessories, where indicated: Safety railing system and ladder-assist post.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

1.1 SUMMARY

- A. Exterior Joints in Vertical Surfaces and Horizontal Nontraffic Surfaces:
 - 1. Construction joints in cast-in-place concrete.
 - 2. Control and expansion joints in unit masonry.
 - 3. Joints between different materials listed above.
 - 4. Perimeter joints around frames of doors and windows.
 - 5. Control and expansion joints in ceilings and other overhead surfaces.
- B. Exterior Joints in Horizontal Traffic Surfaces:
 - 1. Isolation and contraction joints in cast-in-place concrete slabs.
- C. Interior Joints in Vertical Surfaces and Horizontal Nontraffic Surfaces:
 - 1. Control and expansion joints on exposed interior surfaces of exterior walls.
 - 2. Perimeter joints of exterior openings.
 - 3. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - 4. Joints between plumbing fixtures and adjoining walls, floors, and counters.
- D. Interior Joints in Horizontal Traffic Surfaces:
 - 1. Isolation joints in cast-in-place concrete slabs.

1.2 QUALITY ASSURANCE

- A. Preconstruction compatibility and adhesion testing.
- B. Product testing.
- C. Preconstruction field-adhesion testing.
- D. Mockups.

1.3 WARRANTY

- A. Installer: Two years.
- B. Manufacturer: 20 years.

1.4 MATERIALS

- A. Elastomeric Joint Sealants: Liquid applied, chemically curing; ASTM C 920.

1. Nonsag, Pourable polysulfide sealants, Thiokol Base, Federal Specification TT-S-00227, or Hornflex.
 2. Pourable neutral-curing silicone sealants.
 3. Nonsag, neutral- and basic-curing silicone sealants.
 4. Acid-curing silicone rubber sealants, Dow Corning #780.
 5. Mildew-resistant acid-curing silicone sealants.
 6. Nonsag, Pourable urethane sealants.
 - 7.
- B. Solvent-Release Joint Sealants: Acrylic and Butyl rubber, Pigmented narrow joint.
- C. Latex Joint Sealants: ASTM C 834, Type P, Grade NF.
- D. Acoustical Joint Sealants: Latex.
- E. Preformed Joint Sealants: Silicone-sealant system.
- F. Preformed Tape Sealants: Back-bedding mastic, butyl based.
- G. Joint-Sealant Backing: Cylindrical, Elastomeric tubing, and Bond-breaker tape.

1.5 FIELD QUALITY CONTROL

- A. Field-adhesion testing for sealant adhesion to joint substrates.

END OF SECTION 079200

SECTION 081110 - STANDARD STEEL DOORS AND FRAMES

1.1 SUMMARY

- A. Standard hollow-metal steel doors and frames.

1.2 QUALITY ASSURANCE

- A. Quality Standard: ANSI A250.8.

1.3 PRODUCTS

- A. Standard Steel Doors:

1. Design: Flush panel.
2. Thermal-Rated Doors: Exterior.
3. Exterior Doors: Metallic-coated (galvannealed) steel sheet faces.
 - a. Level and Physical Performance Level: Level 3 and Extra Heavy Duty.
 - b. Model: 2 (Seamless).
4. Interior Doors: Cold-rolled steel sheet faces.
 - a. Level and Physical Performance Level: Level 3 and Extra Heavy Duty.
 - b. Model: 1 (Full Flush).

- B. Standard Steel Frames:

1. Exterior Doors: Metallic-coated (galvannealed) steel sheet; welded.
 - a. Frames for Level 3 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
2. Interior Doors: Cold-rolled steel sheet; welded.
 - a. Frames for Level 3 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
 - b. Frames for Wood Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
 - c. Frames for Borrowed Lights: 0.053-inch- (1.3-mm-) thick steel sheet.
3. Door silencers.

- C. Finishes: Factory priming for field painting.

1.4 INSTALLATION

- A. Metal-Stud Partitions: Frames filled with insulation.

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Ogden, Utah

B. Masonry Walls: Frames filled with mortar.

END OF SECTION 081110

SECTION 081416 - FLUSH WOOD DOORS

1.1 QUALITY ASSURANCE

- A. Quality Standard: AWI.
 - 1. AWI Quality Certification Labels or an AWI letter of licensing for doors.
- B. Forest Certification: Doors made with not less than 70 percent of wood products obtained from FSC-certified forests.
- C. Fire-Rated Wood Doors: Positive pressure testing.

1.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade:
 - 1. Heavy Duty unless otherwise indicated.
 - 2. Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces, exits.

1.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Hollow-Core Doors:
 - 1. Grade: Premium, with Grade AA faces.
 - 2. Species: Cherry.
 - 3. Cut: Quarter sliced.
 - 4. Match between Veneer Leaves: Book match.
 - 5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
 - 6. Pair and set match.
 - 7. Construction: Seven plies.
 - 8. WDMA I.S.1-A Performance Grade: Heavy Duty.

1.4 PRIMING/FINISHING

- A. Factory Finishing: All doors.
- B. Transparent Factory Finishes:
 - 1. Grade: Premium.
 - 2. Finish: Catalyzed polyurethane.
 - 3. Effect: Filled finish.

END OF SECTION 081416

SECTION 083110 - ACCESS DOORS AND FRAMES

1.1 SUMMARY

- A. Access doors and frames for walls and ceilings.

1.2 QUALITY ASSURANCE

- A. Fire-Rated Vertical Access Doors and Frames, where indicated: NFPA 252 or UL 10B.

1.3 PRODUCTS

- A. Access Doors and Frames for Walls and Ceilings:

- 1. Type:

- a. Flush access doors and trimless frames.
 - b. Fire-rated, insulated, flush access doors and trimless frames.

- 2. Material: Metallic-coated steel.
 - 3. Fire-Resistance Rating: 45 minutes.
 - 4. Latch: Self-latching bolt operated by flush key with interior release.
 - 5. Lock: Cylinder.

- B. Finishes:

- 1. Metallic-Coated Steel: Baked-enamel finish.

END OF SECTION 083110

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

1.1 SUMMARY

- A. Exterior and interior storefront framing.
- B. Exterior and interior manual-swing entrance doors and door-frame units.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Contractor to design aluminum-framed systems.
- B. Structural Performance:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Seismic Loads: As indicated on Drawings.
- C. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to $L/175$.
 - 2. Deflection Parallel to Glazing Plane: Limited to $L/360$ or 1/8 inch (3.2 mm), whichever is smaller.

1.3 QUALITY ASSURANCE

- A. Quality-control program for structural-sealant-glazed system.
- B. Preconstruction sealant testing.
- C. Mockups for each form of construction and finish.

1.4 WARRANTY

- A. Materials and Workmanship: 10 years.
- B. Finish: 20 years.

1.5 MAINTENANCE SERVICE

- A. Entrance Door Hardware: Six months.

1.6 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer.

- B. Steel reinforcement.

1.7 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members.
 - 1. Construction: Thermally broken.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: As indicated.
- B. Brackets and reinforcements.
- C. Fasteners and accessories.
- D. Concrete and masonry inserts.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing.
- F. Framing system gaskets and sealants.

1.8 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing."
- B. Glazing gaskets.
- C. Spacers and setting blocks.
- D. Bond-breaker tape.
- E. Glazing Sealants:
 - 1. Structural sealant.
 - 2. Weatherseal sealant.

1.9 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors:
 - 1. Door Construction: 2-inch (50.8-mm) overall thickness.
 - 2. Door Design: Medium stile.
 - 3. Glazing stops and gaskets.
- B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

1.10 ALUMINUM FINISHES

- A. Aluminum Finishes: Class II, clear anodic.

1.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner engaged.

1.12 FIELD QUALITY CONTROL

- A. Testing: By Owner-engaged agency.

1.13 ENTRANCE DOOR HARDWARE SETS

- A. As indicated on drawings.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

1.1 SUMMARY

- A. Mechanical door hardware for swinging doors.
- B. Cylinders for door hardware specified in other Sections.
- C. Electrified door hardware.

1.2 WARRANTY

- A. Materials and Workmanship: Three years.

1.3 MAINTENANCE SERVICE

- A. Full-Maintenance Service: Six months.

1.4 PRODUCTS

- A. Scheduled Door Hardware: Products scheduled in "Door Hardware Schedule" on Drawings.

1.5 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Contractor-engaged to perform inspections.
- B. Occupancy Adjustment: After six months.

1.6 DOOR HARDWARE SCHEDULE

- A. Refer to Drawings.

END OF SECTION 087100

SECTION 088000 - GLAZING

1.1 SUMMARY

A. Glazing required for the following:

1. Windows.
2. Doors.
3. Storefront framing.
4. Glazed entrances.
5. Interior borrowed lites.

1.2 PERFORMANCE REQUIREMENTS

A. Engineering design of glass by Contractor.

1.3 QUALITY ASSURANCE

A. Mockups for aluminum-framed entrances and storefronts.

1.4 WARRANTY

- A. Coated-Glass Products: Not less than 10 years.
- B. Insulating Glass: Not less than 10 years.

1.5 MATERIALS

- A. Exterior Glazing: Wind Zone 1.
- B. Glazing Gaskets: Dense compression.
- C. Glazing Tapes: Back-bedding-mastic type.

1.6 MONOLITHIC-GLASS TYPES

- A. Glass Type: Clear float glass, fully tempered where indicated.
- B. Glass Type: Ultraclear float glass, fully tempered float glass where indicated.

1.7 INSULATING-GLASS TYPES

- A. Glass Type: Low-e-coated, clear insulating glass.

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1. Outdoor Lite: Ultraclear float glass, Ultraclear fully tempered float glass where indicated.
2. Indoor Lite: Ultraclear float glass, Ultraclear fully tempered float glass where indicated.

B. Glass Type: Low-e-coated, tinted insulating glass.

1. Outdoor Lite: Tinted float glass, fully tempered tinted float glass where indicated.
2. Indoor Lite: Clear float glass, fully tempered float glass where indicated.

END OF SECTION 088000

SECTION 091110 - NON-LOAD-BEARING STEEL FRAMING

1.1 SUMMARY

- A. Non-load-bearing steel framing members for interior framing and suspension systems.

1.2 MATERIALS

- A. Suspension Systems:

- 1. Wire hangers.
- 2. Flat hangers.
- 3. Carrying channels.
- 4. Furring channels.

- B. Steel Framing for Framed Assemblies:

- 1. Studs and runners.
- 2. Slip-Type Head Joints:
 - a. Deflection track.
- 3. Firestop track, where indicated.
- 4. Flat strap and backing plate.
- 5. Cold-rolled channel bridging.
- 6. Hat-shaped, rigid furring channels.
- 7. Cold-rolled furring channels.
- 8. Z-shaped furring.

END OF SECTION 091110

SECTION 092500 - GYPSUM BOARD

1.1 SUMMARY

- A. Interior gypsum board.
- B. Tile backing panels.

1.2 QUALITY ASSURANCE

- A. Mockups for the following:
 - 1. Levels of gypsum board finish for use in exposed locations.

1.3 MATERIALS

- A. Interior Gypsum Board:
 - 1. Type X.
 - 2. Moisture- and mold-resistant type.
- B. Trim Accessories:
 - 1. Interior.
 - 2. Exterior.

END OF SECTION 092500

SECTION 093000 - TILING

1.1 QUALITY ASSURANCE

- A. Mockup for each type of floor tile installation.
- B. Mockup for each type of wall tile installation.

1.2 TILE PRODUCTS

- A. Tile Type: Unglazed ceramic mosaic tile.
 - 1. Size: 2 by 2 inches (50.8 by 50.8 mm).
 - 2. Trim Shapes: Base cove.
- B. Tile Type: Unglazed paver tile.
 - 1. Size: 11-13/16 by 11-13/16 inches (300 by 300 mm), unless otherwise indicated.
 - 2. Description: Porcelain.
- C. Tile Type: Glazed wall tile.
 - 1. Size: 6 by 6 inches (152 by 152 mm).
 - 2. Trim Shapes: Surface bullnose wainscot cap, Surface bullnose external corner.

1.3 ACCESSORY MATERIALS

- A. Thresholds: Marble.
- B. Tile Backing Panels: Fiber-cement underlayment.
- C. Crack Isolation Membrane: Fabric-reinforced, fluid-applied membrane.
- D. Elastomeric Sealants: Multipart, pourable urethane.
- E. Metal edge strips.

1.4 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floors on Concrete:
 - 1. F111: Cement mortar bed with cleavage membrane.
 - a. Mortar: Medium-bed, latex-portland cement mortar bond coat.
 - b. Grout: Polymer-modified sanded grout.
 - 2. F125A: Thin-set mortar on crack isolation membrane.

- a. Mortar: Latex-portland cement mortar.
- b. Grout: Polymer-modified sanded] grout.

B. Interior Walls, Wood Studs or Furring:

- 1. W244: Thin-set mortar on cementitious backer units or fiber cement underlayment.
 - a. Mortar: Latex-portland cement mortar.
 - b. Grout: Polymer-modified unsanded grout.
- 2. W245: Thin-set mortar on coated glass-mat, water-resistant gypsum backer board.
 - a. Mortar: Latex-portland cement mortar.
 - b. Grout: Polymer-modified unsanded grout.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

1.1 SUMMARY

- A. Acoustical panels and exposed suspension systems.

1.2 QUALITY ASSURANCE

- A. Acoustical Panel Quality Standard: ASTM E 1264.
- B. Metal Suspension System Quality Standard: ASTM C 635.
- C. Mockups for each form of construction.

1.3 MATERIALS

- A. Acoustical Ceiling Panels:
 - 1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
 - 2. Pattern: E1 Un-scored.
 - 3. LR: Not less than 0.85.
 - 4. NRC: Not less than 0.85.
 - 5. CAC: Not less than 30.
 - 6. AC: Not less than 190.
 - 7. Thickness: 3/4 inch (19 mm).
 - 8. Modular Size: 24 by 48 inches (610 by 1220 mm).
- B. Metal Suspension Systems:
 - 1. Wire hangers, braces, and ties.
 - 2. Hanger rods.
 - 3. Seismic perimeter stabilizer bars, struts, and clips.
 - 4. Hold-down clips.
 - 5. Wide-Face, Capped, Double-Web, Heavy duty.
- C. Metal Edge Moldings and Trim: Roll-formed sheet metal.
- D. Acoustical sealants.

1.4 INSTALLATION

- A. Installation: ASTM C 636.

END OF SECTION 095113

SECTION 096340 - STONE FLOORING

1.1 SUMMARY

- A. Section includes the following applications of dimension stone:

1. Interior flooring.

1.2 QUALITY ASSURANCE

- A. Mockup of interior flooring.

1.3 MATERIALS

- A. Stone Types:

1. Granite:
 - a. Variety: As indicated on Drawings.
 - b. Description: Medium-grained, gray, without veining.
 - c. Finish: As indicated.
 - d. Thickness: 3/4 inch (20 mm).

- B. Setting Mortar: Latex-portland cement.

1. Bond Coat: Latex-portland cement.

- C. Pointing Mortar: Pigmented.

- D. Grout: Sanded, polymer-modified cement grout.

- E. Accessories:

1. Divider Strips and Edging: Stainless steel.
2. Abrasive inserts for stair treads
3. Floor sealer.

1.4 FABRICATION

- A. Stone Pattern: Rectangular 18 by 18 inches (457 by 457 mm).

- B. Stone Pattern: Random, rectangular pattern.

1.5 INSTALLATION

- A. Stone over Cleavage Membrane: Set on reinforced mortar setting bed with grouted joints.

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END OF SECTION 096340

SECTION 096510 - RESILIENT BASE AND ACCESSORIES

1.1 PRODUCTS

A. Resilient Base:

1. Material Requirement: Rubber.
2. Style: Cove.
3. Minimum Thickness: 0.125 inch (3.2 mm).
4. Height: 4 inches (102 mm) and 6 inches (152 mm) where indicated on Drawings.
5. Outside Corners: Job formed.
6. Inside Corners: Job formed.

B. Resilient Molding Accessory: Rubber.

1. Reducer strip for resilient floor covering.
2. Transition strips.

C. Installation Materials:

1. Trowelable leveling and patching compounds.
2. Adhesives.
3. Metal edge strips.
4. Floor polish.

END OF SECTION 096510

SECTION 096516 - RESILIENT SHEET FLOORING

1.1 PRODUCTS

A. Vinyl Sheet Floor Covering:

1. Unbacked: 0.080 inch (2.0 mm) thick.
2. Sheet with Backing:
 - a. Overall Thickness: As standard with manufacturer.
 - b. Interlayer Material: None.
 - c. Backing Class: Nonfoamed plastic.
3. Wearing Surface: Smooth.
4. Sheet Width: As standard with manufacturer.
5. Seaming Method: Heat welded.

B. Installation Materials:

1. Trowelable leveling and patching compounds.
2. Adhesives.
3. Seamless-installation accessories.
4. Integral-flash-cove-base accessories.
5. Floor polish.

1.2 INSTALLATION

- #### A. Integral-Flash-Cove Base: Cove floor coverings 6 inches (152 mm) up vertical surfaces.

END OF SECTION 096516

SECTION 096520 - RESILIENT TILE FLOORING

1.1 PRODUCTS

A. Vinyl Composition Floor Tile:

1. Class: Through pattern.
2. Wearing Surface: Smooth.
3. Thickness: 0.125 inch (3.2 mm).
4. Size: 12 by 12 inches (305 by 305 mm).

B. Installation Materials:

1. Trowelable leveling and patching compounds.
2. Adhesives.
3. Seamless-installation accessories.
4. Floor polish.

1.2 FLOOR TILE INSTALLATION

- #### A.
- Lay tiles square with room axis, in pattern indicated.

END OF SECTION 096520

SECTION 096813 - TILE CARPETING

1.1 QUALITY ASSURANCE

- A. Mockups for each type of carpet tile installation.
- B. Products comply with requirements of CRI's Green Label Indoor Air Quality Testing Program.

1.2 WARRANTY

- A. Carpet Tile: 10 years.

1.3 MATERIALS

- A. Carpet Tile:
 - 1. Fiber Content: 100 percent nylon 6, 6.
 - 2. Pile Characteristic: Multilevel Pattern Loop.
 - 3. Density: 6,904 oz./cu. yd. (g/cu. cm).
 - 4. Pile Thickness: 0.146 inches (mm) for finished carpet tile per ASTM D 6859.
 - 5. Stitches: 9.16 stitches per inch (mm).
 - 6. Gage: 1/10 gage in ends per inch (mm).
 - 7. Face Weight: 28 oz.
 - 8. Backing System: Manufacturer's standard synthetic.
 - 9. Size: 24 by 24 inches (610 by 610 mm).
 - 10. Applied Soil-Resistance Treatment: Manufacturer's standard material, S.S.P. Shaw Soil Protection.
 - 11. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: ASTM E-648 flooring radiant panel Class 1, ASTM E-662 Smoke Chamber less than 450.
 - b. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
 - 12. Environmental Requirements:
 - a. Post Industrial Recycled Content: 37.0.
 - b. Green Label Certification #: 59269968.
 - c. Green Label Plus Certification #: GLP9968.

1.4 INSTALLATION

- A. Installation Method: Glue down with releasable adhesive.

END OF SECTION 096813

SECTION 099120 - INTERIOR PAINTING

1.1 SUMMARY

- A. Surface preparation and the application of paint systems on interior substrates.

1.2 QUALITY ASSURANCE

- A. Quality Standards: "MPI Approved Products List" and "MPI Architectural Painting Specification Manual."
- B. Mockups for each color and finish.

1.3 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
 - 1. Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.
- B. Galvanized-Metal Substrates:
 - 1. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N.
- C. CMU Substrates:
 - 1. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.
- D. Gypsum Board Substrates:
 - 1. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.

END OF SECTION 099120

SECTION 099600 - HIGH-PERFORMANCE COATINGS

1.1 SUMMARY

- A. Surface preparation and application of high-performance coating systems.

1.2 QUALITY ASSURANCE

- A. Quality Standards: "MPI Approved Products List" and "MPI Architectural Painting Specification Manual."

1.3 MATERIALS

- A. Undercoats:

- 1. Metal primers.
- 2. Interior primers/sealers.
- 3. Block fillers.

- B. Topcoats:

- 1. Epoxy coatings.
- 2. Polyurethane coatings.

- C. Traffic Paints.

END OF SECTION 099600

SECTION 101100 - VISUAL DISPLAY SURFACES

1.1 QUALITY ASSURANCE

- A. Mockups for each form of construction.
- B. Composite wood products made without urea formaldehyde.

1.2 WARRANTY

- A. Materials and Workmanship for Porcelain-Enamel Face Sheets: Life of building.

1.3 PRODUCTS

- A. Porcelain-Enamel Face Sheet: Enameling-grade steel.
- B. Markerboard Assemblies: Porcelain enamel.
- C. Tackboard Assemblies: Polyester-fabric faced.
- D. Visual Display Rails: Fabric visual display surface.
- E. Support System for Visual Display Boards: Rail.
- F. Markerboard and Tackboard Accessories:
 - 1. Aluminum frames.
 - 2. Trim: Factory-applied aluminum.
 - 3. Chalktray: Solid type.
 - 4. Map rail with clips.
- G. Aluminum Finishes: Class II, clear anodic.

1.4 FABRICATION

- A. Visual Display Boards: Factory assembled.

END OF SECTION 101100

SECTION 101400 - SIGNAGE

1.1 SUMMARY

- A. Plaques.
- B. Dimensional characters.
- C. Panel signs.
- D. Photoluminescent signs.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.3 WARRANTY

- A. Materials and Workmanship: Five years.

1.4 PRODUCTS

- A. Plaques:
 - 1. Cast Plaques: Bronze with concealed stud mounting.
- B. Dimensional Characters:
 - 1. Cast Characters: Bronze with concealed stud mounting.
- C. Panel Signs:
 - 1. Interior Panel Signs:
 - a. Material: Laminated, polycarbonate-faced sheet.
 - b. Frame: Unframed.
 - c. Mounting: Wall with two-face tape.
 - d. Color: As selected by Contracting Officer from manufacturer's full range.
 - 2. Exterior Panel Signs:
 - a. Material: Fiberglass sheet.
 - b. Frame: Unframed.
 - c. Mounting: Wall and post.
 - d. Color: As selected by Contracting Officer from manufacturer's full range.

- D. Applied Vinyl: Die-cut characters from vinyl film applied to exposed face of panel sign.
- E. Photoluminescent Signs: Self-contained, single face "EXIT" sign, UL 924.
 - 1. Mounting: Wall.
 - 2. Face Color: Green.
 - 3. Service Life: 20 years.

1.5 FINISHES

- 1. Cast-Bronze Characters: Manufacturer's standard satin finish.
- 2. Cast-Bronze Plaque:
 - a. Raised Areas: Manufacturer's standard polished.
 - b. Background: Dark oxidized.
- B. Acrylic Sheet: Copy and background colors that are UV and water resistant for five years.

1.6 INSTALLATION

- A. Wall-Mounted Signs, Interior: Two-face tape.
- B. Bracket-Mounted Signs Exterior: Manufacturer's standard mounting.
- C. Dimensional Characters: Manufacturer's standard projected mounting.
- D. Cast-Metal Plaques: Manufacturer's standard concealed mounting.

END OF SECTION 101400

SECTION 102113 - TOILET COMPARTMENTS

1.1 SUMMARY

- A. Phenolic-core toilet compartments configured as follows:
 - 1. Toilet-Enclosure Style: Ceiling hung.
 - 2. Urinal-Screen Style: Post to ceiling.

1.2 QUALITY ASSURANCE

- A. Flame-Spread Index: 25 or less.

1.3 COMPONENTS

- A. Phenolic-Panel Cores: Dark-color.
- B. Door, Panel, and Pilaster Construction: No-sightline system.
- C. Urinal-Screen Post: square stainless-steel tube with satin finish.
- D. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Stainless steel.
- E. Hardware and Accessories: Stainless steel.

END OF SECTION 102113

SECTION 102600 - WALL AND DOOR PROTECTION

1.1 WARRANTY

- A. Materials and Workmanship: Five years.

1.2 PRODUCTS

A. Materials:

- 1. Adhesive VOC content of 70 g/L or less.

B. Corner Guards:

- 1. Surface-Mounted, Metal Type: Stainless steel.
- 2.

C. Wall Guards:

- 1. Crash Rail: With continuous retainer.
 - a. Surface mounted.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

1.1 WARRANTY

- A. Silver Spoilage for Mirrors: 15 years.

1.2 PRODUCTS

- A. Public-Use Washroom Accessories:

- 1. Toilet Tissue Dispenser: Combination, roll toilet tissue.
- 2. Combination Towel Dispenser/Waste Receptacle: Folded towels.
- 3. Liquid-soap dispenser.
- 4. Grab bar.
- 5. Sanitary-napkin disposal unit.
- 6. Mirror unit.

- B. Underlavatory guards.

- C. Custodial Accessories:

- 1. Utility shelf.
- 2. Mop and broom holder.

END OF SECTION 102800

SECTION 105113 - METAL LOCKERS

1.1 PRODUCTS

A. All-Welded, Heavy-Duty Metal Lockers:

1. Arrangement: Double tier.
2. Material: Cold-rolled steel sheet.
3. Body and Shelves: 0.024-inch (0.61-mm) steel sheet.
4. Door Style: Louvered vents at top and bottom.
5. Hinges: Continuous.
6. Door Handle and Latch: Recessed, multipoint.
7. Locks: Built-in combination lock.
8. Equipment: Hooks.
9. Accessories: continuous zee base, continuous sloping tops, filler panels, finished end panels.
10. Finish: Baked enamel or powder coat.

B. Locker Benches:

1. Bench Tops: Laminated clear hardwood.
2. Fixed Pedestals: Tubular steel.

END OF SECTION 105113

SECTION 105200 - FIRE-PROTECTION SPECIALTIES

1.1 SUMMARY

- A. Portable fire extinguishers.
- B. Fire-Protection Cabinets:
 - 1. Portable fire extinguishers.
- C. Mounting brackets for fire extinguishers.

1.2 QUALITY ASSURANCE

- A. Fire Extinguishers: NFPA 10 and FMG listed.

1.3 WARRANTY

- A. Materials and Workmanship for Portable Fire Extinguishers: Six years.

1.4 PRODUCTS

- A. Portable Fire Extinguishers:
 - 1. Multipurpose Dry-Chemical Type: Manufacturer's standard container.
- B. Fire-Protection Cabinets:
 - 1. Type: For fire extinguishers.
 - 2. Construction: Nonrated; 1-hour fire rated.
 - 3. Cabinet Material: Enameled-steel sheet.
 - 4. Mounting: Semirecessed.
 - 5. Door Material: Steel sheet.
 - 6. Door Style: Center glass with frame.
 - 7. Door Glazing: Tempered break glass.
 - 8. Accessories: Mounting brackets, Lettered door handle, Door locks.
 - 9. Finishes:
 - a. Steel Finish: Baked enamel.
- C. Mounting Brackets: Galvanized steel with identification lettering.

END OF SECTION 105200

SECTION 142400 - HYDRAULIC ELEVATORS

1.1 SUMMARY

- A. Hydraulic passenger elevators.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements: ASME A17.1.
 - 1. Effective Peak Velocity Acceleration (A_v): 0.20 or more (seismic risk zones 3 and 4).

1.3 WARRANTY

- A. Elevator Work: One year.

1.4 MAINTENANCE SERVICE

- A. Full Maintenance Service: One year.

1.5 COMPONENTS

- A. Pump Units: Mounted on oil tank in steel enclosure.
 - 1. Motor: Wye-delta or solid-state starting.
- B. Hydraulic Fluid: Biodegradable and fire resistant.
- C. Signal Equipment:
 - 1. Car Control Stations: Recessed type, one per car.
 - 2. Emergency communication system.
 - 3. Firefighters' two-way telephone communication service.
- D. Elevator Description:
 - 1. Cylinder Type: Holeless, telescoping, beside the car.
 - 2. Rated Load: 4000 lb (1816 kg).
 - 3. Rated Speed: 100 fpm (0.51 m/s).
 - 4. Operation System: Single elevator.
 - 5. Auxiliary Operations:
 - a. Standby power operation.
 - b. Automatic dispatching of loaded car.
 - c. Nuisance call cancel.
 - d. Loaded-car bypass.

6. Security Features: Car-to-lobby feature.
 - a. Inside Width: 68 inches (1727 mm).
 - b. Inside Depth: 87-1/2 inches (2222 mm).
 - c. Inside Height: 92 inches (2337 mm).
 - d. Front Walls (Return Panels): Stainless steel.
 - e. Side and Rear Wall Panels: Stainless steel.
 - f. Doors: Stainless steel.
 - g. Ceiling: Stainless steel.
 - h. Handrails: Stainless steel.
 - i. Floor: Prepared to receive stone or ceramic tile.
7. Hoistway Entrances:
 - a. Width: 42 inches (1067 mm).
 - b. Height: 84 inches (2134 mm).
 - c. Type: Single-speed side sliding.
 - d. Frames at First Floor: Stainless steel.
 - e. Frames at Other Floors: Stainless steel.
 - f. Doors at First Floor: Stainless steel.
 - g. Doors at Other Floors: Stainless steel.
8. Hall Fixtures at First Floor: Stainless steel.
9. Hall Fixtures at Other Floors: Stainless steel.

END OF SECTION 142400

DIVISION 21/22/23 - TABLE OF CONTENTS

SECTION NUMBER	SECTION TITLE
211100	FIRE PROTECTION
220523	GENERAL-DUTY VALVES FOR PLUMBING PIPING
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
220548	VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT
220553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
220719	PLUMBING PIPING INSULATION
221410	PLUMBING PIPING
221411	DISINFECTING WATER SUPPLY SYSTEM
221430	PLUMBING SPECIALTIES
223500	DOMESTIC WATER HEAT EXCHANGERS
224440	PLUMBING FIXTURES
224450	PLUMBING EQUIPMENT
226113	COMPRESSED AIR PIPING FOR LABORATORY AND HEALTHCARE FACILITIES
226119	COMPRESSED AIR EQUIPMENT FOR LABORATORY AND HEALTHCARE FACILITIES
226213	VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES
226219	VACUUM EQUIPMENT FOR LABORATORY AND HEALTHCARE FACILITIES
230500	BASIC MECHANICAL REQUIREMENTS
230523	GENERAL-DUTY VALVES FOR HVAC PIPING
230529	BASIC MECHANICAL MATERIALS AND METHODS
230539	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
230548	VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
230593	TESTING, ADJUSTING, AND BALANCING FOR HVAC
230700	MECHANICAL INSULATION
232113	HVAC SPECIALTIES
232123	HVAC PUMPS
232213	STEAM AND CONDENSATE HEATING PIPING
232223	STEAM CONDENSATE PUMPS
232500	HVAC WATER TREATMENT
233300	DUCTWORK AND ACCESSORIES
233400	AIR HANDLING FANS
233410	SPECIAL EXHAUST SYSTEMS
233600	AIR TERMINAL UNITS
233713	AIR INLETS AND OUTLETS
235550	SOLAR ENERGY SYSTEMS
235700	HEAT TRANSFER
236400	REFRIGERATION
236426	ROTARY-SCREW WATER CHILLERS
236500	COOLING TOWERS
237313	MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

SECTION 211000 – FIRE PROTECTION

PART 1 - GENERAL

1.1 FIRE PROTECTION

- A. Provide fire protection water services extensions and connections to on-site utility. Include all connection charges, tap fees, and all other costs required to provide service to the building. Include utility charges for work done and materials installed by the utility company. Provide all pads, vaults, manholes, covers, valve enclosures, valves, service boxes, and other accessories in conformance with the requirements of the serving utility company and local jurisdictional authorities.
- B. Design and install fire protection system in accordance with the current requirements of NFPA 13 and the local AHJ.
- C. Buried piping: Ductile iron, mechanical joint with screw retainer glands; PVC, mechanical joint, ductile fittings, joint restraints.
- D. Piping, above ground: Black steel or galvanized steel, threaded or roll grooved, schedule 40, ASTM A-135 or A-53; in accordance with NFPA 13.
- E. Sprinkler heads; offices, corridors, toilets, and other finished areas: recessed, 165°F, chrome finish.

END OF SECTION 211000

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DOMESTIC, HOT- AND COLD-WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball Valves: One piece, regular port, bronze with bronze trim.
2. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 150.
2. Iron, Grooved-End Butterfly Valves: 175 CWP.
3. Iron Swing Check Valves: Class 125 nonmetallic-to-metal seats.
4. Iron Gate Valves: Class 125.
5. Iron Globe Valves: Class 125.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Pipe hangers and equipment supports designed by Contractor.
- B. Seismic-restraint hangers and supports designed by Contractor and approval obtained from authorities having jurisdiction.

1.2 SUBMITTALS

- A. Shop Drawings: Signed and sealed by a professional engineer.

1.3 QUALITY ASSURANCE

- A. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. ASME Boiler and Pressure Vessel Code.

1.4 COMPONENTS

- A. Metal Pipe Hangers and Supports.
- B. Trapeze pipe hangers.
- C. Thermal-hanger shield inserts.
- D. Fastener Systems.
- E. Pipe Stands.
- F. Pipe positioning systems.
- G. Equipment supports.

END OF SECTION 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 COMPONENTS

A. Vibration Isolators:

1. Isolator Pads: Neoprene.
2. Mounts: Double-deflection type.
3. Restrained Mounts: All directional mountings with seismic restraint; cast-ductile-iron housing.
4. Spring Isolators: Freestanding, laterally stable, open-spring type.
5. Restrained Spring Isolators: Freestanding, steel, open-spring type with seismic restraint.
6. Housed Spring Mounts: Ductile-iron or steel housing, with integral, vertically adjustable seismic snubbers.
7. Elastomeric Hangers: Double-deflection type.
8. Spring Hangers: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression.
9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression and with vertical-limit stop.
10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor.
11. Resilient pipe guides.

B. Vibration Isolation Equipment Bases:

1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

C. Seismic-Restraint Devices:

1. Snubbers: Welded structural-steel shapes and replaceable resilient isolation washers and bushings.
2. Channel Support System: MFMA-3 slotted steel channels.
3. Restraint Cables: Stainless-steel cables.
4. Anchor Bolts: Mechanical type, seismic rated.
5. Resilient Isolation Washers and Bushings: Molded neoprene.

1.2 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 PRODUCTS

- A. Equipment Labels: Plastic.
- B. Warning Signs and Labels: 1/16 inch (1.6 mm) thick with adhesive.
- C. Pipe Labels: Pretensioned.
- D. Stencils: Fiberboard or metal.
- E. Valve Tags: Brass, 0.032-inch (0.8-mm).
- F. Warning Tags: Approximately 4 by 7 inches (100 by 178 mm); brass grommet and wire fasteners.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors; according to ASTM E 84.

1.2 PIPING INSULATION SCHEDULE, GENERAL

- A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Below-grade piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

1.3 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water: Cellular glass, flexible elastomeric, or mineral-fiber, preformed pipe insulation, Type I.
- B. Domestic Hot and Recirculated Hot Water: Cellular glass, flexible elastomeric, or mineral-fiber, preformed pipe insulation, Type I.
- C. Roof Drain and Overflow Drain Bodies: Cellular glass, flexible elastomeric, or mineral-fiber, preformed pipe insulation, Type I.
- D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Flexible elastomeric, or mineral-fiber, preformed pipe insulation, Type I.
- E. Sanitary Waste Piping Where Heat Tracing Is Installed: Cellular glass, or mineral-fiber, preformed pipe insulation, Type I.
- F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F: Cellular glass, flexible elastomeric or mineral-fiber, preformed pipe insulation, Type I.
- G. Hot Service Drains: Cellular glass or mineral-fiber, preformed pipe, Type I or II.

1.4 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Piping, Concealed: PVC, color-coded by system.

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

B. Piping, Exposed: PVC, color-coded by system.

END OF SECTION 220719

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

1.1 SUMMARY

- A. Water service and Fire-service mains and Combined water service and fire-service mains outside the building.

1.2 SUBMITTALS

- A. Coordination Drawings.

1.3 QUALITY ASSURANCE

- A. Quality Standard for Electrical Components, Devices, and Accessories: NFPA 70.
- B. Quality Standard for Materials, Installations, Tests, Flushing, and Valve and Hydrant Supervision for Fire-Service-Main Piping: NFPA 24.
- C. Quality Standard for Plastic Potable-Water-Service Piping: NSF 14. Include marking "NSF-pw" on piping.
- D. Quality Standard for Water-Service Piping and Specialties for Domestic Water: NSF 61.
- E. Quality Standard for Fire-Service-Main Products: FMG's "Approval Guide.

1.4 MATERIALS

- A. Underground Water-Service Piping NPS 3/4 to NPS 3:
 - 1. Soft copper tube and copper solder-joint fittings.
- B. Underground Water-Service Piping NPS 4 to NPS 8:
 - 1. Ductile-iron, mechanical-joint pipe and fittings.
 - 2. Ductile-iron, grooved-end pipe and ductile-iron-pipe appurtenances.
 - 3. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket and spigot end.
- C. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3:
 - 1. Hard copper tube and copper solder-joint fittings.
- D. Aboveground and Vault Water-Service Piping NPS 4 to NPS 8:
 - 1. Ductile-iron, grooved-end pipe and ductile-iron grooved-end appurtenances.
- E. Underground Fire-Service-Main Piping:
 - 1. Ductile-iron, mechanical-joint pipe and fittings.

- F. Aboveground and Vault Fire-Service Main Piping: Ductile-iron, grooved-end pipe and ductile-iron-pipe appurtenances.
- G. Underground Combined Water-Service and Fire-Service-Main Piping:
 - 1. Ductile-iron, mechanical-joint pipe and fittings.
- H. Aboveground Combined Water-Service and Fire-Service-Main Piping: Ductile-iron, grooved-end pipe and ductile-iron-pipe appurtenances.
- I. Special Pipe Fittings: Ductile-iron deflection fittings.
- J. Piping Specialties:
 - 1. Transition fittings.
 - 2. Tubular-sleeve pipe couplings.
 - 3. Split-sleeve pipe couplings.
 - 4. Flexible connectors.
 - 5. Dielectric fittings.
- K. Corrosion-Protection Piping Encasement: Not required.

1.5 MANUFACTURED UNITS

- A. Gate Valves:
 - 1. Cast Iron: Nonrising stem, C500, 200 psig.
 - 2. UL/FMG, Cast Iron: Nonrising stem.
- B. Check Valves: AWWA, UL/FMG, 175 psig.
- C. Not Used.
- D. Water Meters: Compound type with remote registration.
- E. Pressure-Reducing Valves: Water regulators.
- F. Relief Valves: Combination air valves.
- G. Backflow Preventers:
 - 1. Reduced-pressure-principle backflow preventers.
 - 2. Double-check, backflow-prevention assemblies.
 - 3. Reduced-pressure-detector, fire-protection backflow preventer assemblies.
 - 4. Double-check, detector-assembly backflow preventers.
 - 5. Backflow preventer test kits.
- H. Water Meter Boxes: Cast-iron body.
- I. Concrete Vaults: Required.
- J. Protective Enclosures: Freeze protection, Class I-V.

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

- K. Fire Hydrants:
 - 1. Dry barrel, UL/FMG, 150 psig minimum.
- L. Not Used.
- M. Fire Department Connections: Two inlets.
- N. Alarm Devices: Supervisory switches, Pressure switches.

END OF SECTION 221113

SECTION 221313 - FACILITY SANITARY SEWERS

1.1 SUMMARY

- A. Gravity-flow, nonpressure and force-main, pressure sanitary sewerage outside the building.

1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.
- B. Force-Main, Pressure-Piping Pressure Rating: At least equal to system operating pressure but not less than 50 psig.

1.3 COMPONENTS

- A. Backwater Valves: PVC.
- B. Cleanouts: PVC.
- C. Corrosion-Protection Piping Encasement: PE film.
- D. Manholes: Standard precast concrete, Cast-in-place concrete.
 - 1. Resilient pipe connectors.
 - 2. Reinforced-concrete grade rings.
 - 3. Protective coating.
 - 4. Manhole frames and covers.
 - 5. Manhole cover inserts.

1.4 INSTALLATION

- A. Gravity-Flow, Nonpressure Sewer Piping Applications:
 - 1. NPS 4 - 15: ASTM D3034, SDR 35, sewer pipe.
- B. Force-Main, Pressure Piping Applications:
 - 1. NPS 2: PVC Schedule 80, water-service pipe.
 - 2. NPS 3: Ductile-iron, gravity sewer or ductile-iron pressure pipe.
 - 3. NPS 4: Ductile-iron, gravity sewer, ductile-iron pressure or PVC pressure pipe.
 - 4. NPS 6 to NPS 8: Ductile-iron sewer or PVC pressure pipe.
 - 5. NPS 10 and NPS 12: Ductile-iron sewer or PVC pressure pipe.

END OF SECTION 221313

SECTION 221410 – PLUMBING PIPING

PART 1 - GENERAL

1.1 PLUMBING PIPING

- A. Water piping, exterior buried: Copper tube (ASTM B 42-1998), Type K, soldered or brazed joints; PVC ASTM D2241, SDR-26, gasket joints ASTM D3139.
- B. Water piping, interior buried: Copper tube (ASTM B 42-1998), Type K annealed, soldered or brazed joint, brazed joints only below floor structure.
- C. Water piping, interior: Copper tube ASTM B88, Type L, soldered or brazed joints.
- D. Drain waste vent pipe, interior buried: Cast iron ASTM A74 and CISPI HS, service weight, hub and spigot, or No-Hub extra heavy couplings with elastometric gaskets, or PVC DWV pipe and fittings with solvent welded joints.
- E. Drain waste vent pipe, interior: Cast iron ASTM A888 and CISPI 301, service weight, No-Hub or ABS plastic pipe and fittings with solvent welded joints where permitted by local code. Acid waste system (if any) to be Fused PP piping.

1.2 ACID RESISTANT DRAIN, WASTE AND VENT

- A. Polypropylene:
 - 1. Acceptable Manufacturers: Sloan Fuseal, Enfield.
 - 2. Provide polypropylene pipe and fittings, Schedule 40, ASTM D2122, Section 4 and 7, with either electrically induced fusion joints or grooved type mechanical joint.
- B. Glass:
 - 1. Acceptable Manufacturer: O-I/SCHOTT Process Systems, Inc. "KIMAX".
 - 2. Provide borasilica glass pipe, traps and fittings with flouorocarbon polymer lined compression couplings for either plain end or beaded pipe and fittings.
- C. Stainless Steel:
 - 1. Acceptable Manufacturers: Josam, Blucher, Viega.
 - 2. Provide push-fit pipe, traps, fittings, 316 stainless steel with lip seals of EPDM, NBR or FPM as required for application.

1.3 COMPRESSED AIR

- A. Provide Type L Copper tubing and wrought copper fittings with "95-5" Class Sn Sb, soldered joints or Schedule 40 black steel piping with welded joints. Screwed joints may be used on piping under 4" diameter. Press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117.

1.4 LABORATORY VACUUM

- A. Provide Type L Copper tubing and wrought copper fittings with "95-5" Class Sn Sb, soldered joints.

1.5 DISTILLED AND DEIONIZED WATER

- A. Provide Schedule 40 natural polypropylene, having no pigments or plasticizers, pipe and fittings with socket fusion joints.

END OF SECTION 221410

SECTION 221411 – DISINFECTING WATER SUPPLY SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Disinfection of Domestic Water Supply System

1.2 REGULATORY AGENCY REQUIREMENTS

- A. Comply with requirements of Local and State Regulations.

1.3 SUBMITTALS

- A. Submit printed data for the following items:

- 1. Disinfection Report.
- 2. Bacteriological Report.

END OF SECTION 221411

SECTION 221430 – PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Drains and drainage products.
- B. Downspout nozzle.
- C. Cleanouts.
- D. Safe pans and drain flashings.
- E. Sillcocks, hose bibbs.
- F. Pressure gauges, thermometers, and test plugs.
- G. Shock arrestors.
- H. Pressure reducing valves.
- I. Pressure and temperature relief valves.
- J. Washer and dryer wall boxes.
- K. Trap chargers and accessories.

1.2 FLOOR DRAINS (FD)

- A. Acceptable Manufacturers: Wade series 1100, J.R. Smith series 2005, Josam series 30000, Zurn series Z-415.
- B. Schedule:

Plan Code	FD-1	FD-1
Typical Use	Note 2	Note 2
Style	Round	Round
Material	Cast Iron	Cast Iron
Pipe Size	2" - 3"	4"
Top Size	5" min.	7" min.
Strainer	Nickel Bronze	Nickel Bronze
Vandal Proof Security Screws	Yes	Yes
Sediment Bucket	No	No
Seepage Flange	Yes	Yes
Flashing Clamp	Note 1	Note 1
Trap Primer Fitting	Where Required	Where Required
Funnel	No	No
Deep Seal (4") Trap	Yes	Yes

- Note 1: Provide flashing clamp device for drains in areas with waterproof membrane and all drains above slab-on-grade.
- Note 2: Finished areas, showers, toilets, etc.

1.3 FLOOR SINKS (FS)

- A. Acceptable Manufacturers: Wade series 9110/9140, J.R. Smith series 3100/3150, Josam series 49000/49040, Zurn series Z-1900/Z-1910.

B. Schedule:

Plan Code	FS-1
Typical Use	Note 3
Style	Square
Size	12"x12"x8"D
Material	Cast Iron
Finish	Enamel Interior
Grate	Note 1 Cast Iron
Dome Strainer	No
Sediment Bucket	Yes
Seepage Flange	Yes
Flashing Clamp	Note 2
Vandal Resistant Security Screws	No
Trap Primer Fitting	No
Funnel	No

Note 1: Provide full grate unless otherwise noted, provide 1/2 or 3/4 grate where indicated on Drawings.

Note 2: Provide flashing clamp device for drains in areas with waterproof membrane and all drains above slab-on-grade.

Note 3: Indirect waste and floor drainage for mechanical equipment rooms.

1.4 ROOF DRAINS

A. Acceptable Manufacturers: Wade series 3000/3200, J.R. Smith series 1010/1330, Josam series 21500/22080, Zurn series Z-100/Z-125.

B. Schedule:

Plan Code	RD
Material	Cast Iron
Size	8" nom.
Dome	Poly
Flashing Clamp	Yes
Deck Clamp	Yes
Bearing Pan/Receiver	Yes
Vandal Proof Security Screws	Yes
Adjustable Extension	No
Pipe Size	2"-4"

1.5 OVERFLOW DRAIN

A. Acceptable Manufacturers: Wade series 3000/3200, J.R. Smith series 1010/1330, Josam series 21500/22080, Zurn series Z-100/Z-125.

B. Schedule:

Plan Code	OD-2
Material	Cast Iron
Size	8" nom.
Dome	Poly
Flashing Clamp	Yes
Deck Clamp	Yes
Bearing Pan/Receiver	Yes
Vandal Proof Security Screws	Yes
Stand Pipe	Note 1
Dam	Note 1

Note 1: Provide overflow drains with 2" high stand pipe or dam as appropriate for the style of drain furnished.

1.6 DOWNSPOUT NOZZLES

A. Acceptable Manufacturers: Wade series 3940, J.R. Smith series 1770, Josam series 25010, Zurn series Z-199.

B. Schedule:

Plan Code	DSN
Material	Bronze
Wall Flange	Yes
Size	2"-8"

1.7 FLOOR CLEANOUTS

A. Acceptable Manufacturers: Wade series 6000, J.R. Smith series 4020/4100,4200, Josam series 56000, Zurn series Z-1400.

B. Cast iron adjustable body, ABS plug.

1.8 WALL CLEANOUTS

A. Acceptable Manufacturers: Wade series 8560 with 8480R, J.R. Smith series 4530, Josam series 58790, Zurn series 1446.

B. Cast iron cleanout tee, ABS plug, stainless steel cover with screw.

1.9 SAFE PANS AND DRAIN FLASHINGS

A. Provide one of the following systems:

1. 4 lb./sq.ft. sheet lead with 15 lb. asphaltic felt sub pan (underliner).
2. #24 B&S gauge (0.021") minimum sheet copper with 15 lb. asphaltic felt sub pan (underliner).
3. 0.040" non-plasticized chlorinated polyethylene sheet with 30 lb. felt underliner.
4. 3 ply 15 mil polyvinylchloride sheet with 30 lb. felt underliner.

1.10 WATER HEATER SAFETY PAN (WHSP)

- A. Provide Shamrock Industries Inc. or equivalent gray polyethylene pan 2" larger than heater diameter with side or bottom drain fitting as required by drawings on electric water heaters installed above ceilings, under counters or on wood flooring.
- B. Provide Ruud Mfg. Co. "Heater Pan" or equivalent spun aluminum pan with side or bottom drain fitting as required by drawings on gas fired water heaters installed on combustible foundations with 3/4" thick fire proof liner between pan and combustible construction.

1.11 SILLCOCK, EXPOSED, NON-FREEZE

- A. Acceptable Manufacturers: Woodford series 65, J.R. Smith series 5609, Josam series 71200, Zurn series Z-1310, Wade series 8600.
- B. Schedule:

Plan Code	SC-1
Freeze Proof	Yes
Vacuum Breaker	Yes
Material	Brass
Finish	Chrome
Outlet	3/4" Hose Thread
Operator	Loose Key
Wall Clamp	Yes

1.12 HOSE BIBBS

- A. Acceptable Manufacturers: As listed in Schedule.

B. Schedule:

Plan Code	HB-1	HB-2	HB-3
Typical use	Note 1	Note 2	Note 3
Material	Brass	Brass	Brass
Finish	Polished Chrome	Polished Chrome	Rough Brass
Vacuum Breaker	Yes	Yes	Yes
Outlet	3/4" Hose Thread	3/4" Hose Thread	3/4" Hose Thread
Operator	Loose Key	Lever or Tee	Tee or Wheel
Wall Flange	Yes	Yes	Yes
Chicago Faucet	No. 952	No. 13	No. 13T
Woodford	-----	24 P	24
T & S Brass	B-720	B736-POL	-----

Note 1: Toilet rooms, Janitor's mop station, etc.

1.13 STATIONARY PRESSURE GAUGES

A. Acceptable Manufacturers: Trerice 600C series, Weksler Regal series.

B. Schedule:

Plan Code	PG
Type	4-1/2" Dial
Bourbon Tube/Socket	Phosphor Bronze Tube Brass Socket
Accuracy	ANSI B40.1 Grade 1A 1% F.S. over middle half of range
Case	Cast Aluminum
Window	Clear Glass
Snubber	Yes
Coil Syphon	For Steam Service
Gauge Cock	Yes
Set Hand	No
Silicone Filled	No
Weatherproof	No

C. Range: Select gauges for the following standard ranges unless otherwise indicated on drawings, or as required for special systems.

- Domestic Water 0 to +160 psi

1.14 STATIONARY THERMOMETERS

A. Acceptable Manufacturers: Trerice Industrial Series, Ametek Industrial Series.

B. Schedule:

Plan code:	T-1
Type	Adjustable angle
Case	9" cast aluminum
Window	Clear acrylic
Tube	Red mercury
Stem	Aluminum, insertable
Separable Socket	Brass

C. Range: Select thermometers, for the following standard ranges unless otherwise indicated on Drawings, or as required for special systems.

1. Heating water 30 to 240 °F
2. Domestic cold water 0 to 100 °F
3. Domestic hot water 30 to 240 °F

1.15 TEMPERATURE AND PRESSURE TEST PLUGS (T&PTP)

- A. Acceptable Manufacturers: Terice, Fairfax, Peterson Equipment (Pete's Plug).
- B. Plugs suitable for vacuum to 600 psig and temperature of -20°F to 300°F with cap and extension for insulated pipe where required.

1.16 SHOCK ARRESTORS FOR WATER (SA)

- A. Acceptable Manufacturers: Precision Plumbing Products Co., Wade Shokstop, J.R. Smith series 5000, Josam series 75000, Zurn Z-100.
- B. Schedule:

Plan Code	"P.D.I." Size	Fixture Units
SA-A	A	1-11
SA-B	B	12-32
SA-C	C	33-60
SA-D	D	61-113
SA-E	E	114-154
SA-F	F	155-330

1.17 REDUCED PRESSURE BACKFLOW PREVENTER

- A. Acceptable manufacturers: Conbraco Series 40-200, Watts series 009 and 909, Febco series 825Y, Hersey series FRP-II.

- B. Bronze body, independent spring loaded check valves, diaphragm type differential pressure relief valve, air gap drain fitting, shut-off ball valves, strainer, test cocks. Suitable for water temperature range of 33-140 °F.
- C. Approved under ASSE 1013 and AWWA C511.
- D. Backflow preventer test kit: Provide complete test kit including pressure gauge, test valves, high pressure hoses, adaptor fittings, mounting strap, and instructions, in a corrosion resistant carrying case.

1.18 PRESSURE REDUCING VALVE (PRV)

- A. Acceptable Manufacturers: Watts series 25AUB, Conbraco series 36.
- B. 300 psi bronze body, replaceable seat, strainer, adjustable outlet pressure, thermal expansion bypass. Suitable for water temperature up to 160°F.
- C. Approved under ASSE 1003 and IAPMO.

1.19 TEMPERATURE AND PRESSURE RELIEF VALVES (T&P)

- A. Acceptable Manufacturers: Kunkle, Watts, Conbraco, McDonnell and Miller.

1.20 TRAP CHARGERS AND ACCESSORIES (NO PLAN CODE)

- A. Acceptable Manufacturer: Precision Plumbing Products, Co. (PPP)

END OF SECTION 221430

SECTION 223500 - DOMESTIC-WATER HEAT EXCHANGERS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Performance Efficiency: ASHRAE/IESNA 90.1 and ASHRAE 90.2.
- B. ASME Compliance: ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. NSF Compliance: NSF 61, "Drinking Water System Components - Health Effects."

1.2 WARRANTY

- A. Materials and Workmanship:
 - 1. Plate, Domestic-Water Heat Exchangers: One year.
 - 2. Compression Tanks: One year.

1.3 PLATE, DOMESTIC-WATER HEAT EXCHANGERS

- A. Frame-and-Plate, Domestic-Water Heat Exchangers:
 - 1. Heating Fluid: Steam.
 - 2. Pressure Rating: 150 psig.
 - 3. Plate Walls: Vented, double.
 - 4. Plate Thickness: 0.024 inch (0.6 mm).
- B. Capacity and Characteristics:
 - 1. Recovery: 150 gph at 100 deg F temperature rise.

1.4 DOMESTIC-WATER, HEAT-EXCHANGER ACCESSORIES

- A. Domestic-Water Compression Tanks: Steel tank with welded joints and butyl-rubber diaphragm; 150-psig pressure rating.
 - 1. Piping-type heat traps.
 - 2. Heat-Trap Fittings: ASHRAE 90.2.
 - 3. Combination temperature-and-pressure relief valves.
 - 4. Pressure relief valves.
 - 5. Vacuum relief valves.

END OF SECTION 223500

SECTION 224440 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Fixtures and Trim.
- B. Plumbing Fixture Accessories.

1.2 REFERENCES

- A. Comply with the applicable provisions and recommendations of the following:
 - 1. ANSI A112.19.2 – Vitreous China Plumbing Fixtures.
 - 2. ANSI A112.19.3 – Stainless Steel Plumbing Fixtures.

1.3 QUALITY ASSURANCE

- A. Qualification:
 - 1. Provide fixtures trim and specialties in accordance with style, type, quality and function as established by the named manufacturer and model specified for each item.
 - 2. Provide all installations in accordance with jurisdictional code and health authorities standards, restrictions and recommendations.
 - 3. Provide all fixtures and trim using a single manufacturer where possible, deviation will be allowed only where specifications indicate otherwise.

1.4 ACCEPTABLE MANUFACTURERS

- A. Cast iron and vitreous china: Kohler – Eljer – American Standard – Crane – Toto.
- B. Stainless steel sink 302 18-gauge minimum: Elkay – Just.
- C. Terrazzo: Fiat – Florestone – Stern Williams – Bradley.
- D. Water Mixing Valves Thermostatic, or Pressure Balanced: Leonard – Symmons – Kohler – Powers – Lawler.
- E. Flush Valves: Sloan Royal – Delany Flushboy – Zurn.
- F. Toilet Seats: Olsonite – Beneke – Sperzel – Bemis – Church.
- G. Traps, Stops, Supplies, Airgaps, Drains: Kohler- Eljer – American Standard – Bridgeport – Brasscraft – Dearborn – Sayco – Frost – Eastman.

- H. Chair Carriers: Josam – J. R. Smith – Zurn – Wade.
- I. Faucets: Kohler – Eljer – American Standard – Bradley – Valley – Elkay – Chicago – Delta – Cambridge Brass.
- J. Kitchen Equipment Trim: Fisher – Chicago Faucet – T & S Brass – Cambridge Brass.

1.5 WATER CLOSETS

- A. Wall Mount, Siphon Jet, Tank Operated, Water Saver, 12" rough with open front and open back seat:

Plan Code:	WC-1	WC-2
Make:	Kohler	Kohler
Model:	K-4330	K-4330
Seat Make:	Bemis	Bemis
Model:	1655C	1655C
Bolt Caps: (Typ. of 2)	K-4561	K-4561
Color:	White	White
Set, Floor to Rim:	14"	18" (ADA)
Valve:		

1.6 LAVATORIES

- A. Wall Hung, Vitreous China, Carrier Mounted:

Plan Code:	L-1
Make:	Kohler
Model:	K-2032
Size:	20" x 18"
Hole Drilling	3 @ 2" OC
Trap:	K-9000 1-1/4"
Faucets	0.5 gpm, hard-wired sensor
Lever Control Handles:	K-15593
Drains:	K-7715
Carrier Make:	Smith
Model:	700
to Rim:	See Architectural Elevation

1.7 URINALS

A. Wall Hung, Carrier Mounted, Valve Operated Siphon Jet:

Plan Code:	U-1
Make:	Kohler
Model:	K-5016-ET
Style:	1-1/4" Top Spud
Set Floor to Rim (STD):	U-24"
Set Floor to Rim (ADA):	U-17"
Flush Valve	1/8 gpf
Make:	Zurn
Model:	180-YB
Supply:	1"
Carrier	
Make:	Wade
Model:	W400

1.8 SINKS

A. Stainless Steel, Self Rim:

Plan Code:	S-1	S-2
Make:	Elkay	With Casework
Model:	LR-2521	Acid Resistant
Compartments:	1	1
Gauge Min.:	18	Acrylic
S.S. Type Min.:	302	-

1.9 LAVATORY THERMOSTATIC MIXING VALVES

- A. Adjustable high temperature limit stop (factory set for 110°F), thermostatic type, inlet checkstops. Provide recessed locking stainless steel cabinet where indicated.
- B. Provide valves of sizes and capacities scheduled on Drawings.
- C. Models:
 - 1. Exposed: Leonard 210-SB, Symmons Series 5.
 - 2. S.S. Cabinet: Leonard TA-254-STSTL, Symmons Series 5B.

1.10 FIXTURE SUPPLIES & STOPS

A. Schedule:

DF & Lavatory Supplies:	(L.K. Stops, 12" Riser, 1/2 x 3/8)	
Make:	Brass Craft	Bridgeport Frost Dearborn
Model:	SCR 1912	1694 LK 7824-2LK 2712 KCW
DF & Lavatory Supplies:	(W.H. Stops, 12" Riser, 1/2" x 3/8")	

Make:	Brass Craft	Bridgeport	Frost	Dearborn
Model:	CR 1912	1694	7824-2	2712 SCW
Bidet & Sink Supplies:		(L.K. Stop, 20" Riser, 1/2" x 1/2")		
Make:	Brass Craft	Bridgeport	Frost	Dearborn
Model:	SCR 3920	1666 or 1786	8135-2/8218-2	None
Bidet & Sink Supplies:		(W.H. Stop, 20" Riser, 1/2" x 1/2")		
Make:	Brass Craft	Bridgeport	Frost	Dearborn
Model:	CR 3920A	1695 MOD	7816-2	None
Water Closet Tank Supplies:		(L.K.) Stop. 12" Riser, 1/2 x 3/8)		
Make:	Brass Craft	Bridgeport	Frost	Dearborn
Model:	SCR 1912 DL	1770 LK	7925-2LK	3112 KCW
Water Closet Tank Supplies:		(W.H. Stop, 12" Riser, 1/2 x 3/8)		
Make:	Brass Craft	Bridgeport	Frost	Dearborn
Model:	CR 1912 DL	1170	7925-2	3112 SCW

1.11 FIXTURE CONNECTIONS

- A. Provide supply and waste connections for fixtures in accordance with the following table of minimum sizes or larger as required by jurisdictional codes, or drawings.

Fixture Description:	Hot Water:	Cold Water:	Waste:	Vent:
Water Closet (WC)				
Flush Valve:	NA	1"	4"	2"
Water Closet (WC)				
Tank Operated:	NA	1/2"	4"	2"
Lavatory (L):	1/2"	1/2"	1-1/4"	1-1/4"
Urinal (U):				
Flush Valve:	NA	3/4"	2"	1-1/2"
Service Sinks (SS):	1/2"	1/2"	3"	1-1/2"
Sink (S):	1/2"	1/2"	1-1/2"	1-1/2"
Electric Water Cooler (EWC):	NA	1/2"	1-1/4"	1-1/4"

END OF SECTION 224440

Ogden Weber Applied Technology College
Health Technology Building
Ogden, Utah

SECTION 224450 – PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 WATER HEATERS (STEAM-TO-WATER)

- A. Gas fired, 90% efficiency minimum, storage tank type, glass-lined tank, 125 psig ASME construction, insulated steel jacket, immersion thermostat.

END OF SECTION 224450

SECTION 226113 - COMPRESSED-AIR PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Compressed-air piping for the following:

1. Dental air.

1.2 QUALITY ASSURANCE

- A. Quality Standards: NFPA 99 for healthcare facilities.

1.3 MATERIALS

- A. Piping:

1. Dental Air Piping: Type L, copper medical gas tube; wrought-copper fittings; brazed joints.
2. Drain Piping: Copper water tube, cast- or wrought-copper fittings; soldered joints.

- B. Valves:

1. Ball Valves: Three-piece body, brass or bronze.
2. Check Valves: In-line pattern, bronze.
3. Zone Valves: Three-piece body, full-port ball valves with gage.
4. Zone Valve Boxes: Formed or extruded aluminum, recessed mounting.
5. Safety Valves: ASME constructed, bronze.
6. Pressure Regulators: Bronze; spring-loaded, diaphragm-operated relieving type.
7. Automatic Drain Valves: Stainless steel.

- C. Flexible Pipe Connectors: Corrugated bronze, 200 psig minimum.

1.4 FIELD QUALITY CONTROL

- A. Contractor-engaged agency.

END OF SECTION 226113

SECTION 226119 - COMPRESSED-AIR EQUIPMENT FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design compressed-air equipment mounting.
- B. Seismic Performance: Compressed-air equipment shall withstand the effects of earthquake motions.

1.2 QUALITY ASSURANCE

- A. Quality Standards:
 - 1. Receiver Tanks: ASME Boiler and Pressure Vessel Code.
 - 2. Medical Compressed-Air Equipment and Accessories: NFPA 99.
 - 3. Medical and Dental Equipment: UL 544.
- B. Testing Agency Qualifications: An independent testing agency that is an NRTL.

1.3 MANUFACTURED UNITS

- A. Control Panels: Automatic control station with load control and protection functions.
- B. Packaged, Oil-Free Reciprocating Air Compressors:
 - 1. Air Compressor(s): [One] [Two] [Three], [single] [or] [two] stage.
 - 2. Mounting: [Freestanding] [Tank mounted].
 - 3. Receiver: [Horizontal] [Vertical] steel tank.
 - 4. Automatic control switches to [alternate lead-lag air compressors for duplex] [and] [sequence lead-lag air compressors for multiplex] air compressors.
- C. Packaged, Oilless Reciprocating Air Compressors:
 - 1. Air Compressor(s): [One] [Two] [Three], [single] [or] [two] stage.
 - 2. Mounting: [Freestanding] [Tank mounted].
 - 3. Receiver: [Horizontal] [Vertical] steel tank.
 - 4. Automatic control switches to [alternate lead-lag air compressors for duplex] [and] [sequence lead-lag air compressors for multiplex] air compressors.
- D. Packaged, Liquid-Ring Air Compressors:
 - 1. Air Compressor(s): Two.
 - 2. Mounting: Tank mounted.
 - 3. Receiver: Horizontal steel tank.

4. Automatic control switches to alternate lead-lag air compressors for duplex air compressors.
- E. Inlet-Air Filters: Combination filter-silencer for each air compressor(s).
- F. Compressed-Air Dryers: Refrigerant type.
- G. Compressed-Air Purification Systems: With coalescing, particulate, and activated-charcoal filters; compressed-air dryer; catalytic converter; gages and thermometers; and controls.
- H. Compressed-Air Filter Assemblies: Particulate, odor and taste, and coalescing filters.
- I. Dental Compressed-Air Equipment Control Panels: Wall-mounting type with visual indicators.
 1. Shut off dental air equipment.
 2. Shut off water supply to dental air equipment.

1.4 INSTALLATION

- A. Vibration Isolation: Equipment installed with restrained-spring isolators.

END OF SECTION 226119

SECTION 226213 - VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Vacuum piping for the following systems:

1. Dental vacuum.

1.2 QUALITY ASSURANCE

- A. Quality Standards: NFPA 99 for healthcare facilities.

1.3 MATERIALS

- A. Piping:

1. Dental Vacuum Piping: Type L, copper medical gas tube; wrought-copper fittings; brazed joints.
2. Drain Piping: Copper water tube, cast- or wrought-copper fittings; soldered joints.

- B. Valves:

1. Ball Valves for Copper Tubing: Three-piece body, brass or bronze, ball and bronze check.
2. Zone Valves: Three-piece body, full-port ball valves with gage.
3. Zone Valve Boxes: Formed or extruded-aluminum, recessed mounting.
4. Safety Valves: ASME construction, bronze.
5. Automatic Drain Valves: Stainless steel.

- C. Computer interface cabinet.

- D. Flexible Pipe Connectors: Corrugated bronze, 200 psig minimum.

1.4 FIELD QUALITY CONTROL

- A. Contractor-engaged agency.

END OF SECTION 226213

SECTION 226219 - VACUUM EQUIPMENT FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Vacuum equipment mounting.
- B. Seismic Performance: Vacuum equipment shall withstand the effects of earthquake motions.

1.2 QUALITY ASSURANCE

- A. Quality Standards:
 - 1. Receiver Tanks: ASME Boiler and Pressure Vessel Code.
 - 2. Medical Vacuum Equipment and Accessories: NFPA 99.
 - 3. Medical Vacuum Equipment: UL 544.
- B. Testing Agency Qualifications: An independent testing agency that is[a member of the Medical Gas Professional Healthcare Organization or is] an NRTL.

1.3 MANUFACTURED UNITS

- A. Control Panel: Automatic control station with load control and protection functions.
- B. Packaged, Oil-Free, Rotary, Sliding-Vane Vacuum Pumps:
 - 1. Vacuum Pump(s): Two.
 - 2. Mounting: Freestanding.
 - 3. Receiver: Vertical steel tank.
 - 4. Automatic control switches to alternate lead-lag vacuum pumps for duplex vacuum pumps.
- C. Dental Vacuum Equipment Control Panels: Wall-mounting type with visual indicators.
 - 1. Shut off dental vacuum equipment.
 - 2. Shut off water supply to dental vacuum equipment.

1.4 INSTALLATION

- A. Vibration Isolation: Equipment installed with elastomeric pads.

END OF SECTION 226219

SECTION 230500 – BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 WATER AND SEWER UTILITIES

- A. Provide all building services extensions and connections to on-site utilities (approximately five feet from building). Provide all pads, vaults, manholes, covers, enclosures, valves, service boxes, and other accessories in conformance with the requirements of the serving utility company.
- B. Arrange for owner to pay sewer connection charges and water system development fees.

1.2 OPERATING AND MAINTENANCE DATA (O&M Manual)

- A. Division 23 Contractor shall submit (3) typed and bound copies and (3) electronic (indexed pdf) copies of the operations and maintenance manual to the Owner.

1.3 COORDINATION

- A. General: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.
- B. Utility Interruptions: Coordinate mechanical utility interruptions with the Owner and the Utility Company. Plan work so that duration of the interruption is kept to a minimum.
- C. Each Division 23 subcontractor shall coordinate with other contractors to make certain that any of his equipment, piping or ductwork, which is mounted on isolators or flexibly connected, does not become "grounded" by another contractors work (e.g. walls, ceiling, etc.).

1.4 CLEANING AND FINISHING

- A. Provide cleaning in accordance with the General Conditions of the Contract and Division 1.
- B. Cleaning shall include but not be limited to removing grease, dirt, dust, stains, labels, fingerprints, and other foreign materials from sight-exposed piping, ductwork, equipment, fixtures and other such items installed under Division 23 of the work. If finishes have been damaged, refinish to original condition and leave everything in proper working order and of intended appearance.

1.5 WARRANTIES

- A. Warranty: Provide a written warranty to the Owner covering the entire mechanical work to be free from defective materials, equipment and workmanship for a period of one year after Date of Acceptance. During this period provide labor and materials as required to repair or replace defects. Provide certificates for such items of equipment, which have warranties in excess of one year. Submit to the Construction Manager/General Contractor for delivery to the Architect. Include a copy of all warranties in the Operation of Maintenance Manual.
- B. This warranty will be superseded by the terms of any specific equipment warranties or warranty modifications resulting from use of equipment for construction heat or ventilation.

1.6 CERTIFICATES AND KEYS

- A. Certificates: Upon completion of the work, deliver to the Construction Manager/General Contractor one copy of Certificate of Final Inspection.
- B. Keys: Upon completion of work, submit keys for mechanical equipment, panels, etc. to the Construction Manager/General Contractor.

END OF SECTION 230500

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 CHILLED-WATER, CONDENSER WATER, HEATING WATER VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Angle Valves: Class 125, bronze disc.
2. Ball Valves: One piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 150.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, ductile-iron disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. Iron Swing Check Valves: Class 125, metal seats.
5. Iron, Grooved-End Check Valves: 300 CWP.
6. Iron Gate Valves: Class 125, NRS.
7. Iron Globe Valves: Class 125.
8. Lubricated Plug Valves: Class 125, regular gland.
9. Eccentric Plug Valves: 175 CWP, resilient seating.

1.2 LOW-PRESSURE STEAM VALVES (15 PSIG (104 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Angle Valves: Class 125, bronze disc.
2. Ball Valves: Three] piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 150.
2. High-Performance Butterfly Valves: Class 150, single flange.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125, NRS.
5. Iron Globe Valves: Class 125.

1.3 HIGH-PRESSURE STEAM VALVES (MORE THAN 15 PSIG (104 kPa))

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Angle Valves: Class 150, bronze disc.

2. Ball Valves: Three piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, RS, bronze.
5. Globe Valves: Class 150, bronze, bronze disc.

B. Pipe Sizes NPS 2-1/2 (DN 65) and Larger:

1. Ball Valves: Class 150, iron.
2. High-Performance Butterfly Valves: Class 150, single flange.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125, NRS.
5. Iron Globe Valves: Class 125.

1.4 STEAM-CONDENSATE VALVES

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Angle Valves: Class 125, bronze disc.
2. Ball Valves: Three piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, RS.
5. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 150.
2. High-Performance Butterfly Valves: Class 150, single flange.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Gate Valves: Class 125, NRS.
5. Iron Globe Valves: Class 125.
6. Lubricated Plug Valves: Class 125, regular gland.

END OF SECTION 230523

SECTION 230529 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 MOTORS

- A. Constructed to NEMA MG-1; 40°C, continuous duty at full load; Design "B" Polyphase induction type for 3 horsepower and larger; permanent split capacitor single phase type for ½ horsepower and smaller; open drip-proof for indoor locations, totally enclosed type for outdoor installation; Ball or roller bearings; Derate motors for project altitude (5600 ft.); High efficiency type in accordance with NEMA MG-1, except motors that are an integral part of packaged equipment may be manufacturer's standard.

1.2 STARTERS

- A. Provide starters for operation of all mechanical equipment; conform to Division 26 specifications.

1.3 IDENTIFICATION

- A. Identify all service valves using brass tags indicating service and location.
- B. Identify all piping using pressure sensitive markers or semi-rigid plastic markers indicating pipe contents and flow direction.
- C. Identify all mechanical equipment, controls, starters, and similar equipment using engraved nameplates.

1.4 WARRANTIES

- A. Provide original copies of all warranties and extended warranties for specific equipment where specified and in accordance with Section 230500.

END OF SECTION 230529

SECTION 230539 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Pipe hangers and equipment supports designed by Contractor.
- B. Seismic-restraint hangers and supports designed by Contractor and approval obtained from authorities having jurisdiction.

1.2 SUBMITTALS

- A. Shop Drawings: Signed and sealed by a professional engineer.

1.3 QUALITY ASSURANCE

- A. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. ASME Boiler and Pressure Vessel Code.

1.4 COMPONENTS

- A. Metal Pipe Hangers and Supports: Carbon steel.
- B. Trapeze pipe hangers.
- C. Thermal-hanger shield inserts.
- D. Fastener Systems.
- E. Pipe Stands.
- F. Equipment supports.

END OF SECTION 230539

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 COMPONENTS

A. Vibration Isolators:

1. Isolator Pads: Neoprene.
2. Mounts: Double-deflection type.
3. Restrained Mounts: All directional mountings with seismic restraint; cast-ductile-iron housing.
4. Spring Isolators: Freestanding, laterally stable, open-spring type.
5. Restrained Spring Isolators: Freestanding, steel, open-spring type with seismic restraint.
6. Housed Spring Mounts: Ductile-iron or steel housing, with integral, vertically adjustable seismic snubbers.
7. Elastomeric Hangers: Double-deflection type.
8. Spring Hangers: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression.
9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression and with vertical-limit stop.
10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor.
11. Resilient pipe guides.

B. Air-Mounting Systems:

1. Air Mounts: Freestanding, single or multiple, compressed-air bellows.
2. Restrained Air Mounts: Housed compressed-air bellows.

C. Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail; with spring isolators mounted on elastomeric isolation pads, and snubber bushings.

D. Vibration Isolation Equipment Bases:

1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

E. Seismic-Restraint Devices:

1. Snubbers: Welded structural-steel shapes and replaceable resilient isolation washers and bushings.
2. Channel Support System: MFMA-3 slotted steel channels.
3. Restraint Cables: Stainless-steel cables.
4. Anchor Bolts: Mechanical type, seismic rated.
5. Resilient Isolation Washers and Bushings: Molded neoprene.

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1.2 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Quality Standard for Piping Identification: ASME A13.1.

1.2 PRODUCTS

- A. Equipment Labels: Plastic.
- B. Warning Signs and Labels: 1/8 inch thick with fasteners.
- C. Pipe Labels: Pretensioned.
- D. Duct Labels: 1/8 inch thick with adhesive.
- E. Stencils: Aluminum.
- F. Valve Tags: Brass, 0.032-inch minimum thickness.
- G. Warning Tags: 3 by 5-1/4 inches minimum; brass grommet and wire fasteners.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Testing, adjusting, and balancing for the following:

1. Air Systems: Constant-volume and variable-air-volume systems.
2. Hydronic Systems.
3. Steam systems.
4. Heat exchangers.
5. Motors.
6. Chillers.
7. Cooling towers.
8. Heat-transfer coils.

1.2 QUALITY ASSURANCE

A. Testing, Adjusting, and Balancing Agent Qualifications: AABC, NEBB or TABB certified.

1.3 EXECUTION

- A. Tolerances: Plus or minus 10 percent of design values.
- B. Inspections: Random checks by Architect to verify final testing, adjusting, and balancing report.
- C. Additional Tests: Random tests within 90 days of completing TAB to verify balance conditions and seasonal tests.

END OF SECTION 230593

SECTION 230700 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 INSULATION

- A. Domestic Hot Water, Circulating, and Tempered Water: Fiberglass; entire system. Domestic Cold Water: Fiberglass; vapor barrier; horizontal piping above ceiling. Roof Drain: Fiberglass; vapor barrier; horizontal mains and vertical to drain bowl; drain bowls only on overflow drain system.
- B. Heating Water: Fiberglass; entire system.
- C. Outside Air Duct: Fiberglass board; vapor barrier; exterior surfaces. Supply Duct, Concealed: Rectangular duct; branch duct and round runouts – No insulation, "acoustical lining".
- D. All insulation thicknesses in accordance with current edition of the (IECC) International Energy Conservation Code.
- E. Jackets: Exterior – 0.016-inch corrugated aluminum. Interior, exposed piping – all purpose insulation jacket. Interior, Mechanical Rooms: PVC jacket color in conformance with Campus standards.
- F. Handicap Lavatory Insulation: Pre-molded closed cell foam insulation kit.

END OF SECTION 230700

SECTION 232113 – HVAC SPECIALTIES

PART 1 - GENERAL

1.1 SPECIALTIES

- A. Air separators: Steel, ASME rated for 125 psig, integral strainer, with automatic vent valve, blowdown connection.
- B. Expansion tanks: Compression type, welded steel, ASME Section 8D tested and stamped for 125 psig, EPDM diaphragm.

1.2 PUMP SUCTION FITTINGS

- A. Pump suction fitting shall match specified pump provided by Contractor.

1.3 GLYCOL FILL SYSTEM

- A. Mixing Tank: 45 gallon poly drum with fittings suitable for filling, low level switch, and electric pump for charging. Pressure switch actuated controls with pre-wired control panel. Control panel shall include pump H-O-A switch and push button to silence low level alarm.

1.4 FLOW MEASURING STATIONS (VENTURI)

- A. Venturi stations shall be one-piece bronze threaded 1/2" through 3". Sizes 2-1/2" through 8" shall consist of one-piece cadmium plated cast steel Venturi with weld neck or flanged ends.

1.5 BALANCING VALVES (TERMINAL EQUIPMENT)

- A. Furnish and install calibrated balancing valves with screwed, sweated, or flanged connections suitable for 125 psig. Maximum working temperature shall be 250°F. Valves shall be equipped with brass readout valves fitted with an integral EPT insert and check valves designed to minimize system fluid loss during the balancing and monitoring process. Each balancing valve shall have a calibrated nameplate to assure specific valve settings, be constructed with internal seals to prevent leakage and be supplied with preformed Polyurethane insulation suitable for use on heating and cooling system.

1.6 CHILLED WATER STORAGE TANKS

- A. Provide an ASME stamped tank for flow through of chilled water, rated for 125 psig working pressure. Tank to be fabricated of welded steel. Provide storage volume and dimensions indicated on the schedule sheets.

END OF SECTION 232113

SECTION 232123 – HVAC PUMPS

PART 1 - GENERAL

1.1 CENTRIFUGAL PUMPS

- A. In-line: Cast iron, bronze fitted, mechanical seal, motor in accordance with 230529 and selected to be non-overloading.
- B. Base Mounted: Single stage, cast iron bronze fitted, enclosed impeller, mechanical seal, flexible coupler, motor in accordance with 230529 and selected to be non-overloading.

END OF SECTION 232123

SECTION 232213 - STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. LP and HP steam and condensate piping for systems inside the building.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures:
 - 1. HP Steam Piping: 125 psig.
 - 2. LP Steam Piping: 15 psig.
 - 3. Condensate Piping: 30 psig.
 - 4. Makeup-Water Piping: 80 psig (552 kPa) at 150 deg F.
 - 5. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
 - 6. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
 - 7. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

1.3 QUALITY ASSURANCE

- A. Quality Standard: ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping."

1.4 PRODUCTS

- A. Dielectric Fittings:
 - 1. Dielectric unions.
 - 2. Dielectric flanges.
 - 3. Dielectric-flange kits.
- B. Strainers:
 - 1. Y-pattern.
 - 2. Basket.
- C. Flash Tanks: Fabricated according to ASME Boiler and Pressure Vessel Code.
- D. Safety Valves: ASME labeled; bronze and cast iron.
- E. Pressure-Reducing Valves: Cast iron; pilot operated; diaphragm type.

F. Steam Traps:

1. Thermostatic.
2. Thermodynamic.
3. Float and thermostatic.
4. Inverted bucket.

G. Thermostatic air vents.

H. Vacuum breakers.

I. Condensate Meters: Turbine type; interface with central workstation.

END OF SECTION 232213

SECTION 232223 - STEAM CONDENSATE PUMPS

PART 1 - GENERAL

1.1 PRODUCTS

A. Pressure-Powered Pumps:

1. Configuration: Duplex pump with float-operated valve control.
2. Receiver: Cast iron, factory mounted on steel supports.

1.2 STARTUP SERVICE

- A. Startup service by a factory-authorized service representative.

1.3 DEMONSTRATION

- A. By a factory-authorized service representative.

END OF SECTION 232223

SECTION 232500 – HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 HVAC WATER TREATMENT

- A. Pre-startup Cleaning: Clean all HVAC water systems with liquid alkaline dispersant cleaner.

1.2 CHEMICAL FEED

- A. Closed Systems, Chilled Water: Bypass pot feeder, 175 psig working pressure, liquid borate nitrite corrosion inhibitor,azole inhibitor.

1.03 WATER TREATMENT CONTROL SYSTEM FOR OPEN SYSTEMS

- A. Acceptable Manufacturers:

Water Treatment Control System: Lakewood Instruments, LMI.
Chemical Feed Pump: LMI, Prominent, Precision.

- B. Provide a completely automatic Control System for inhibitor application and blow-down for the open recirculating water system. Blow-down shall be conductivity activated and directly responsive to all variables that affect evaporation, blow-down and make-up quantities.
- C. System shall contain an electronic conductivity controller equipped with "flow" through sensing probe, "Power On" and "Blow-down" indicator lights, a system test button, and grounded 3 wire power cord. Conductivity controller, when sensing maximum permissible conductance of the circulating water, shall simultaneously open a valve on the blow-down line and activate a chemical feed pump for application of specified scale and corrosion inhibitors.
- D. Provide two Chemical Feed Pumps of suitable materials of construction that shall have adequate capacity to handle biocides and chemical inhibitors of variable pH.
- E. Provide a motorized valve of sufficient size for adequate blow-down.
- F. Biocide Programmer solid state, programmable with digital display and battery backup.
- G. Open systems over 100 tons capacity shall also have a TDS control system for the cooling water.
- H. Provide spill containment basin under chemical treatment stand. Size basin to include pumps, chemical drums, and mounting stand. Construct basin of polyethylene, polypropylene, FRP, concrete, or other approved material. Secure basin and stand as required by Section 230548 – Mechanical Seismic Control.

- I. Provide an organic phosphonate based scale inhibitor containing molybdate and zinc based corrosion inhibitors and sludge dispersants. The treatment shall be in liquid form and be suitable for feeding into the system directly from the shipping container. This chemical treatment must not contain chromate or phosphate.
- J. Provide algaecides of two different types of formulations to be used on an alternating basis and to be effective against all normally encountered algae and slime growths. Algaecides must be isothiazolone or gluteraldehyde.
- K. Chemicals used in direct evaporative cooling media sumps shall be approved for use in the supply air stream by OSHA and EPA.

END OF SECTION 232500

SECTION 233300 – DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.1 DUCTWORK

- A. Galvanized steel sheets, ASTM A527, G90 zinc coating to ASTM A525, fabricate in accordance with SMACNA duct construction standards, 1.5 radius elbows, 45 degree take-offs.
- B. Flexible duct: Nonmetallic, insulated, UL 181 Class 1 air duct, polyethylene core, galvanized steel wire helix, fiberglass insulation, reinforced polyester vapor barrier, 6-inch w.g. working pressure.
- C. All ductwork, hangers, fasteners, dampers, diffusers, etc. located in the NMR Labs shall be aluminum.

1.2 VOLUME DAMPERS

- A. Rectangular, 16-gauge galvanized steel hat channel frame, 16-gauge galvanized steel blades maximum 8-inches wide, opposed blade action, suitable for velocity to 1500 fpm and pressure to 2.5-inch w.g., locking indicating quadrant regulators.

1.3 CONTROL DAMPERS

- A. Rectangular, 16-gauge galvanized steel hat channel frame, galvanized steel double skin air foil blades maximum 6-inches wide, opposed blade action, elastometric blade edge seals, metal jamb seals.

1.4 MATERIALS

- A. Nonmetallic air ducts and connectors shall conform to UL 181 Class 0 or Class 1.
- B. Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G90 zinc coating each side in conformance with ASTM A90.
- C. Stainless Steel Ducts: ASTM A167, Type 304.
- D. PVC coated steel ducts: UL 181 class 1, G60 galvanized steel spiral lockseam duct or sheets coated with polyvinyl chloride 4-mil (0.004-inch) thick on both sides. Factory fabricate fittings of same material as duct with welded seams or stainless steel rivets and PVC sealant.
 - 1. Acceptable manufacturers: Foremost manufacturing; Norlock Metal Products; United McGill; Wheeling Service and Supply.

- E. Fiberglass reinforced polyester (FRP) ducts: Filament wound or hand lay-up fabrication in accordance with NBS PS 15-69 and NFPA91; visual defects shall be in accordance with ASTM D2563 Acceptance Level II; minimum 30-mil thick inner corrosion liner; select resin for compatibility with temperature, pressure, exposure, and air stream contaminants.

- 1. Acceptable manufacturers: ATS Products Inc., Peabody Spunstrand.

1.5 LOW PRESSURE DUCTWORK

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures specified or as indicated on drawings.

1.6 MEDIUM PRESSURE DUCTWORK

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures specified or as indicated on drawings.

END OF SECTION 233300

SECTION 233400 – AIR HANDLING FANS

PART 1 - GENERAL

1.1 CABINET FANS

- A. Cabinet shall be constructed of steel with removable panels for access to all internal parts.

1.2 CENTRIFUGAL FANS, UTILITY SET

- A. Type: To be of the centrifugal type, completely assembled with fan, fan scroll, motor, belt drive, motor mount and motor housing.

1.3 CENTRIFUGAL FANS

- A. Type: The fans to be backward inclined air-foil type completely assembled with fan, fan scroll, motor, belt, drive, belt guard and motor mount, capacity and arrangement as shown on the Drawings, and certified performance tests by Air Moving and Conditioning Association (AMCA) to be submitted with the shop drawing.

1.4 ROOF EXHAUSTERS

- A. Centrifugal, formed aluminum housing, aluminum backward inclined wheel, adjustable belt drive, disconnect switch, birdscreen, gravity backdraft damper, completely factory assembled and tested. Mount on nominal 12-inch high insulated roof curb.

1.5 PROPELLER TYPE VENTILATION FAN

- A. Type: Shall be of the belt driven type.

1.6 POWER ROOF VENTILATORS

- A. Furnish and install power roof ventilators of model, size, and capacity as shown on drawings.

1.7 EXHAUST FANS (CEILING TYPE)

- A. Type: Shall be of the centrifugal fan, integral grille and housing type, all completely self-contained with backdraft damper and UL listed.

END OF SECTION 233400

SECTION 233410 – SPECIAL EXHAUST SYSTEMS

PART 1 - GENERAL

1.1 FUME EXHAUST FAN

A. Fan Construction:

1. The fan housing shall be manufactured from Atlac 711 or Dow Chem 510 resin or equal by Koppers, and shall be resistant to the corrosive fumes, liquids and gases listed for fume scrubber. This resin shall be self extinguishing, nonburning type with a flame spread of 25 or less according to the ASTM E84 tunnel test.
2. Centrifugal exhaust fans shall have an outlet located in the bottom most section of the fan housing to facilitate removal of any condensate which may form in the fan housing. Outlet shall be threaded female NPT. If insert is used, it must be of the material which bonds readily to the FRP housing construction and has equal reactions to ambient conditions in order to prevent failure due to corrosion or swelling or shrinkage. Housing in area of this fitting shall be built up as required to accept increased stresses of pipe connection. Minimum size 3/4" NPT. An additional outlet shall be provided at 45 deg. from the bottom to permit rotation of discharge 45 deg. (angle up).

END OF SECTION 233410

SECTION 233600 – AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 VAV LOW PRESSURE ZONE TERMINAL UNITS

- A. Terminal units designated of sizes shown on drawings or terminal unit schedule. Units shall have factory catalog performance ratings which conform to cfm, static pressure, discharge and radiated sound power and attenuation designated.

END OF SECTION 233600

SECTION 233713 – AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 CEILING DIFFUSERS

- A. Round or square, louvered face, white finish, aluminum.

1.2 PLENUM RETURN GRILLES

- A. Aluminum, perforated face, white finish, with sound absorbing boot constructed of fiberglass duct board.

1.3 RETURN/EXHAUST GRILLES

- A. Aluminum, perforated face, white finish, steel back panel with duct collar.

1.4 LOUVERS

- A. Extruded aluminum blades 0.080-inch thick, on 37.5 degree angle, 6-inch deep extruded aluminum frame, birdscreen, anodized finish of color selected by Architect from full range of available colors.

END OF SECTION 233713

SECTION 235550 - SOLAR ENERGY SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Solar Fluid Tubing, Fittings, and Joints.
- B. Solar Fluid Valves.
- C. Solar Fluid Pumps.
- D. Solar Fluid Heat Exchanger.
- E. Solar Collectors.
- F. Thermal Storage Tank.
- G. Solar Fluid.
- H. Solar System Controls.
- I. Solar Expansion Tanks.
- J. Air Separators.
- K. Air Elimination Valve.
- L. Solar Fluid Reclaim System.
- M. Over Temperature Protection.
- N. Solar System Controls.

1.2 REFERENCES

- A. Reference Standards: Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:
 - 1. Comply with ASHRAE 93-77 (ANSI B198.1) Methods of Testing TO DETERMINE THE THERMAL PERFORMANCE OF SOLAR COLLECTORS.

1.3 EXTRA STOCK

- A. Solar Fluid: Provide sufficient Inhibited Propylene Glycol to maintain specified concentrations in Solar Fluid Piping Systems during one year warranty period.

PART 2 - PRODUCTS

2.1 SOLAR FLUID TUBING, FITTINGS AND JOINTS

- A. Solar Heating System: Provide copper tube type L with AWS Class BCup brazing and wrought fittings.
- B. Copper tube shall conform to ASTM B-88.

- C. Wrought copper and bronze solder joint fittings size 5" and smaller shall conform to ANSI B16.22.

2.2 SOLAR FLUID VALVES

A. General:

- 1. Provide valves as specified herein and as indicated on the Drawings complete with accessories and attachments as required and appropriate.

2.3 SOLAR FLUID PUMPS

- A. Provide in-line fluid lubricated type circulating pumps, stainless steel or bronze fitted construction, one piece enclosed type impeller hydraulically and dynamically balanced, stainless steel shaft with tungsten carbide shaft sleeve, and over load protection, 145 psig @ 240 deg.F rating.

2.4 SOLAR FLUID HEAT EXCHANGER (Double Wall Tube)

- A. Provide heat exchanger with double wall copper tubes and manifolds with leak detection feature, all supported on a steel frame and enclosed in a 20 gage steel insulated jacket.

2.5 SOLAR COLLECTORS

- A. Provide manufacturer's standard or custom fabricated liquid solar collector units, complete with provisions for installation/anchoring in the positions indicated.
- B. The flat plate collector modules from the top to the bottom in cross-section shall consist of the following layers:
 - 1. A tempered, single glass cover plate, 1/8 inch minimum thickness, low iron content. Edges to be nested in EPDM gasket. Minimum solar transmittance of 90%.
 - 2. An inner air space between glazing inner surface and absorber top surface.
 - 3. An all copper absorber plate, with selective surface coating, containing copper passage ways for circulating solar fluid. Absorber plate shall be soldered, brazed or mechanically bonded to the collector fluid passages. The contact areas of the absorber plate with fluid passages shall be 50% of the exterior area of the fluid passage tube. Effective absorber area shall not be less than 91 % of total frontal area. The edge and ends of the absorber panel shall be thermally insulated from the casing. Fluid passage tubes and manifold shall be pressure tested to 150 psi working pressure. Selective surface shall be black chrome over nickel substrate with a minimum absorptivity of 0.92 and a maximum emissivity of 0.15.

4. A backside layer of high temperature insulation with material to meet the following:
 - a. Minimum "U" factor 0.10 Btu/Sq. ft./deg. F for total thickness.
 - b. Insulation shall withstand temperatures of up to 450 F without "outgasing" thermal resistance degradation, or creating a fire hazard.
 5. Internal perimeter insulation.
 6. Coated Aluminum backplate.
 7. The layers shall be supported with an aluminum steel frame and covered with a backside cover plate. The exterior casing of the panel shall be sheet metal or extruded aluminum bolted, screwed or welded together, rigid enough to support total unit including glass in handling and shipping without undue deflection, and have mounting brackets at easily accessible points for ease of installation. Casing and glazing frame shall allow for removal and replacement of cover glass without removing the collector panel. Casing must be weatherproof without additional housing or flashing. Minimum condensation due to temperature changes within collector housing (and not due to rain, wind or snow) is acceptable.
 8. Materials used in casing, gasketing, glazing, mounting and finishing shall not "outgas" at temperatures up to 400 deg.F. All materials and assemblies must be capable of operating over an ambient temperature range of from -40 deg.F to 130 deg.F and of -40 deg.F to 400 deg.F internal temperature range within collector casing. Collectors shall not exceed 4.5 lbs/sq. ft. of total frontal area. All collector modules shall be identical in size and appearance.
- C. Mounting Provision: The sides and/or ends of the collector casing shall be designed to allow for easy mounting of collectors to support frame. Manufacturer to furnish all supports, bracing and cross-bracing to withstand 55 PSF wind (146 mph) loading from any direction.

2.6 THERMAL STORAGE TANKS (Domestic Hot Water Preheat)

- A. Provide an NSF Approved, ASME Certified and Labeled and National Board Certified vertical NSF approved epoxy phenolic or polyamide lined, domestic hot water preheat storage tank for 125 psig working pressure.
- B. Factory paint tank with rust inhibitor primer and finish with two coats of heat resistant black epoxy enamel.
- C. Tank tappings shall be provided as detailed or appropriate, ASME welded tank flanges or nipples.
- D. Provide a sensor well for the installation of a thermistor.

2.7 SOLAR FLUID

- A. Description: An inhibited propylene glycol that is clear and odorless.

2.8 SOLAR FLUID EXPANSION TANKS

- A. Acceptable Manufacturers: Wessels, Amtrol, B & G, Taco.
- B. Provide an EPDM diaphragm-type expansion tank which will accommodate the expanded solar fluid of the system generated within the operating temperature range, limiting this pressure increase at all components. It shall maintain minimum operating pressure necessary to eliminate all air. The only air in the system shall be the permanent sealed-in air cushion contained in the EPDM diaphragm-type tank. The expansion tank shall be welded steel, constructed, tested and stamped in accordance with Section VIII of the ASME Code for a working pressure of 125 psi and pre-charged to the minimum operating pressure.

2.9 AIR SEPARATOR

- A. Provide cast iron air separator, constructed in accordance with ASME Code (Section VIII) for a working pressure of 125 psi.

2.10 AUTOMATIC AIR ELIMINATION VALVE

- A. Acceptable Manufacturers: Amtrol, B & G, Taco.
- B. Provide cast iron air elimination valve with non-corrosive working parts, working pressure of 125.

2.11 SOLAR SYSTEM CONTROLS

- A. Provide differential temperature controllers which have adjustable setpoint mechanisms that may be varied by manual control, internal adjustable methods, unless specified otherwise, in 14 ga. steel panel wall mounted.
- B. All filled system temperature sensors shall be provided to meet the design parameters, unless otherwise specified.
- C. Provide pre-heat domestic water temperature sensor to control solar fluid circulating pump.

PART 3 - EXECUTION

3.1 SOLAR FLUID TUBING, FITTINGS AND JOINTS

- A. General:
 - 1. All copper tube and fittings shall be reamed and buffed prior to brazing or soldering.
 - 2. The use of 50-50 solder of any class, for joint make-up or back-up for finishing is prohibited.

3. Refer and conform to the Copper Development Association instructions for proper preparation and actual installation practice for all brazed joints.
4. Support tube in accordance with Section 230529.
5. Slope all piping to insure complete drain down of solar fluid system during service.

3.2 INSTALLATION OF SOLAR FLUID VALVES

A. General:

1. Provide valves as shown on Contract Documents and as required for balancing and/or control of flow.
2. Provide isolation valves for maintenance and service on each piece of equipment regardless of whether or not shown on Contract Drawings.
3. Provide isolation valves for all branch line take-offs that serve more than two items of equipment.
4. Provide balancing valves for all returns and/or supplies to equipment as shown on Contract Documents.

- B. Provide ASME temperature and pressure relief valves, with full size drains extended and air gapped to approved receptor. Provide relief valves on all pressure vessels per ASME Standard.

3.3 SOLAR FLUID PUMPS

- A. Install pumps in accordance with manufacturer's instructions. Provide access space around pumps for service, minimum as recommended by Manufacturer.

3.4 SOLAR FLUID HEAT EXCHANGER (Double Wall Tube)

- A. Allow for tube (coil) pull without destruction, keep all piping and other equipment clear of coil pull area.
- B. Provide dielectric connections to all units.
- C. Provide thermometers and pressure gages on inlet and outlet of solar fluid piping.
- D. Units shall be set to provide for complete drain down thru drain valve to be provided at low point.
- E. Provide isolation valves to allow for complete unit or component removal without removal of connecting piping, locate valves adjacent and outside the union connections.

3.5 SOLAR COLLECTORS

- A. General: Except as otherwise indicated, install liquid solar collectors, including components required, in accordance with Manufacturer's instructions.

3.6 THERMAL STORAGE TANKS (DHW)

- A. Provide structural 2" dia. schedule 40 black steel welded pipe stand with 2" pipe cross bracing, 6" x 6" x 1/8" steel leg support plates, 3" wide rolled steel (to tank diameter) saddles with 1/8" plate stiffeners, 3" wide x 1/4" thick neoprene pads between saddles and tank.

3.7 CLEANING OF SOLAR FLUID PIPING SYSTEMS

- A. Provide for the cleaning of the Solar Fluid Piping Systems after hydrostatic tests have been completed and prior to the operating tests in accordance with Section 232500 - HVAC Water Treatment.

3.8 SOLAR FLUID

- A. After each system has been cleaned and flushed as described in "CLEANING OF SOLAR FLUID PIPING SYSTEMS", it shall be filled with a solution of water and 50 percent by volume of inhibited propylene.

3.9 SOLAR EXPANSION TANKS

- A. Tank to be connected to the suction side of pump piping on the solar fluid return.
- B. Provide unions and gate valves for complete isolation of the tank from the system.

3.10 AIR SEPARATOR

- A. Install on pump suction side piping.
- B. Provide unions and gate valves for complete isolation of the separator from the system.
- C. Clean strainer after 24 hours operation and after 30 days operation.

3.11 AUTOMATIC AIR ELIMINATION VALVE

- A. Install in accordance with Manufacturers recommendations as located on Drawings.

3.12 SOLAR FLUID RECLAIM TANK AND PUMP.

- A. Provide basin level and plumb.
- B. Coordinate wall mounted "on-off" toggle switch for pump and electrical power requirements with Division 26 Contractor in accordance with Section 230529 - Basic Mechanical Materials and Methods.

- C. Set pump level, plumb and square where indicated on Contract Documents on vertical pipe leg extended to and supported by floor. Provide floor plate for capped leg at floor.

3.13 TESTING AND BALANCING

- A. System shall be tested and balanced in accordance with Section 230593 - Testing, Adjusting and Balancing.
- B. Pressure Tests: Before testing piping systems, remove or otherwise protect from damage, control devices, air vents and other parts which are not designed to stand pressure used in testing piping.
- C. Hydrostatic Pressure: Test hydronically, piping for all services to 175 psi for at least six consecutive hours, during which time pressure shall remain constant without pumping. Subject copper joints to soap suds while under hydrostatic pressure.

3.14 SOLAR SYSTEM CONTROLS

- A. General: Install system and materials in accordance with Manufacturer's instructions and roughing-in drawings, and details on Drawings. Install electrical work and use electrical products complying with requirements of applicable Division - 26 sections of these specifications. Mount controllers at convenient locations and heights.
- B. Wiring: The term "wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connecting electric control devices. Follow collector Manufacturer recommendations for collector mounted sensors.
- C. Wiring System: Provide complete wiring system for electric-electronic controls. Conceal wiring, except in mechanical rooms and areas where other conduit and piping are exposed. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly. Follow Manufacturers recommendations for grounding control wiring system.
- D. Number-code or color-code conductors, excluding those used for local individual controls, for future identification and servicing of control system.
- E. Unit-Mounted Equipment: Where control devices are indicated to be unit-mounted, ship electric relays, electric switches, valves, dampers and damper motors to unit Manufacturer for mounting and wiring at factory.
- F. After completion of installation, adjust thermostats, control valves, motors and similar equipment provided as Work of this Section.
- G. Final adjustment shall be performed by specially trained personnel.

END OF SECTION 235550

SECTION 235700 – HEAT TRANSFER

PART 1 - GENERAL

1.1 PRODUCTS

A. SHELL-AND-TUBE HEAT EXCHANGERS

1. Configuration: U-tube with removable bundle.
2. Shell Material: Steel.
3. Head Material: Cast iron.
4. Tube Material: Seamless copper.
5. Tubesheet Material: Steel.
6. Baffle Material: Steel.
7. Support Saddles: Fabricated of material similar to shell. Foot mount with provision for anchoring to support.

1.2 CHILLED, CONDENSER, AND HEATING WATER COILS

- A. Coils shall be suitable for chilled water, hot water, or glycol service with 5/8" diameter copper tubes of 0.035" wall thickness. Maximum fins per inch shall be 10. Aluminum fin thickness shall be 0.010 inch maximum.

1.3 UNIT HEATER (HORIZONTAL BLOW)

- A. Type: Unit heater shall be of the horizontal blow thru propeller fan type with hot water heating coil, capacities as shown on the drawings.

1.4 FAN COIL UNITS

- A. Units shall consist of coils, drain pan assembly, filter, and centrifugal fan with drive mounted in a common cabinet for independent air delivery from a single unit. Units shall be complete except for controls. All oiling connections shall be extended to exterior of casing to facilitate maintenance without removing sound proofing on exterior of unit.

END OF SECTION 235700

SECTION 236400 – REFRIGERATION

PART 1 - GENERAL

1.1 INLINE SOLIDS SEPARATOR

- A. Packaged solids separator system to consist of a centrifugal separator, basket strainer, pump, piping, gauges, starter with HOA switch, disconnect, single-point wiring panel, and control panel all mounted on a welded steel skid.

1.2 FAN COIL UNITS

- A. Units shall consist of coils, drain pan assembly, filter, and centrifugal fan with drive mounted in a common cabinet for independent air delivery from a single unit. Units shall be complete except for controls. All oiling connections shall be extended to exterior of casing to facilitate maintenance without removing sound proofing on exterior of unit.

1.3 CASSETTE-STYLE COOLING-ONLY DUCTLESS DX FAN COIL SPLIT SYSTEMS WITH AIR COOLED CONDENSING UNITS

- A. Furnish and install factory assembled cooling-only split systems of the type, size and capacity shown on the equipment schedule on the Drawings. Unit performance shall be certified in accordance with latest edition of ARI Standards 210 and 270.

END OF SECTION 236400

SECTION 236426 - ROTARY-SCREW WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Packaged, water-cooled, single-compressor water chillers.

1.2 QUALITY ASSURANCE

- A. Certification: ARI 550 for water-cooled chillers and ARI 590 for air-cooled chillers.
- B. Compliance: ASHRAE 15 and 147, ASHRAE/IESNA 90.1, ASME, NFPA 70, UL.
- C. Performance Rating: ARI 550/590.
- D. Sound Rating: ARI 370 for chillers located outdoors and ARI 575 for chillers located indoors.

1.3 PACKAGED, WATER-COOLED, SINGLE-COMPRESSOR CHILLERS

- A. Compressor: Hermetic
- B. Capacity Control: Modulating slide-valve assembly or port unloaders.
 - 1. Operating Range: From 100 to 20 percent of design capacity.
 - 2. Condenser-Fluid Unloading Requirements over Operating Range: Drop-in entering condenser-fluid temperature of 2.5 deg F/1.4 deg C drop for each 10 percent in capacity reduction.
- C. Oil Lubrication System:
 - 1. Pump.
 - 2. Oil filter.
 - 3. Heater.
 - 4. Refrigerant- or water-cooled oil cooler.
 - 5. Factory-wired power connection.
 - 6. Controls.
- D. Refrigerant Circuit:
 - 1. Refrigerant Type: R-134a; HFC.
 - 2. ASME-rated, spring-loaded, pressure relief valve.
 - 3. Refrigerant circuit isolation valves.
- E. Evaporator:
 - 1. Water Box: Standard, hinged.
 - 2. Tubes: Copper with enhanced internal finish.

- F. Condenser:
 - 1. Water Box: Standard, hinged.
 - 2. Tubes: Copper with enhanced internal finish.
 - G. Electrical Power: Single-point, field-power connection to fused disconnect switch.
 - H. Motor Controllers: Solid state, reduced voltage.
 - 1. Enclosure: Factory installed, unit mounted with lock and key.
 - 2. Control Circuit: Integral control power transformer.
 - 3. Accessories:
 - a. Externally operated, fused disconnect switch.
 - b. Push-button stations, pilot lights, and selector switches.
 - c. Stop and lockout push-button station.
 - d. Time-delay relays.
 - e. Elapsed-time meters.
 - f. Number-of-starts counter.
 - g. Multifunction digital-metering monitor.
 - h. Phase-failure, phase-reversal, and undervoltage relays.
 - i. Power-protection shut down.
 - I. Controls: Microprocessor based.
 - 1. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, digital display.
 - 2. BAS Interface: Communication interface.
 - J. Insulation for Cold Surfaces: Closed-cell, flexible elastomeric.
 - K. Accessories:
 - 1. Flow Switch: Pressure differential type.
 - 2. Vibration Isolation: Neoprene pads.
 - 3. Sound Barrier: Removable and reusable sound-barrier covers over the compressor housing, hermetic motor, compressor suction and discharge piping, and condenser shell.
- 1.4 PACKAGED REFRIGERANT RECOVERY UNIT
- A. Packaged portable unit consisting of compressor, air-cooled condenser, recovery system, tank pressure gauges, filter-dryer, and valving.
- 1.5 SOURCE QUALITY CONTROL
- A. Factory tested.
 - B. Evaporator and Condensers: Factory tested and inspected according to ASME Boiler and Pressure Vessel Code.

END OF SECTION 236426

SECTION 236500 - COOLING TOWERS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. ASHRAE/IESNA 90.1 for energy efficiency.
- B. ASME Compliance: ASME Boiler and Pressure Vessel Code: Section VIII, Division 1 for heat-exchanger coils.
- C. CTI Certification: CTI STD 201 for thermal performance.

1.2 WARRANTY

- A. Materials and Workmanship: Five years.

1.3 PRODUCTS

- A. Open-Circuit, Induced-Draft, Counterflow or Crossflow Cooling Towers:
 - 1. Casing: Stainless steel.
 - 2. Collection Basin: Stainless steel.
 - 3. Collection Basin Water-Level Control: Mechanical float assembly and valve.
 - 4. Basin Heater: Electric.
 - 5. Pressurized Water Distribution Piping: PVC pipe with nonclogging nozzles.
 - 6. Fill: CPVC.
 - 7. Drift Eliminator: Removable FRP or PVC.
 - 8. Air-Intake Louvers: FRP.
 - 9. Air-Intake Screens: Removable stainless-steel wire mesh.
 - 10. Fan: Axial; aluminum blades.
 - 11. Fan Drive: Multiple V-belt Direct Gear.
 - 12. Fan Motor: Totally enclosed air over (TEAO); NEMA Premium Efficient; severe-duty rating.
 - 13. Fan Discharge Stack: Manufacturer's standard design.
 - 14. Vibration Switch: For each fan drive with manual-reset button.
 - 15. Gear Drive, Oil-Level Switch: Low-oil-level warning switch for connection to BMS.
 - 16. Controls: Factory installed and wired, and functionally tested at factory before shipment.
 - 17. Personnel Access Components: Ladders and cages, platforms, and handrails, constructed of FRP.

1.4 SOURCE QUALITY CONTROL

- A. Cooling Towers: Tested and certified according to CTI STD 201.

1.5 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency.
- B. Testing Procedures: ASME PTC 23, "ASME Performance Test Codes - Code on Atmospheric Water Cooling Equipment."

END OF SECTION 236500

SECTION 237313 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Variable-air-volume, single-zone air-handling units.

1.2 QUALITY ASSURANCE

- A. Quality Standards: ARI 430, NFPA 70, and NFPA 90A.

1.3 COMPONENTS

- A. Unit Casing:

1. Outside Casing: Galvanized steel.
2. Coatings.
3. Inside Casing: Galvanized steel.
4. Floor Plate: Aluminum.
5. Cabinet Insulation: 2 inches (50 mm) thick.
6. Static-Pressure Classifications for Unit Sections before Fans: 2-inch wg (500 Pa).
7. Static-Pressure Classifications for Unit Sections after Fans: 6-inch wg (1 500 Pa).
8. Inspection access panels and access doors.
9. Condensate Drain Pans: Single-wall, stainless-steel sheet, integral part of floor plating.
10. Service Platforms: Galvanized steel.
11. Mounting Frame: Galvanized-steel channels with seismic restraints.

- B. Supply Fan Section:

1. Drive: Direct.
2. Fan Wheels: Centrifugal.
3. Internal vibration control.
4. Motors.

- C. Return Fan Section:

1. Drive: Direct.
2. Fan Wheels: Centrifugal.
3. Internal vibration control.
4. Motors.
5. Variable frequency controllers.

- D. Coils:

1. Coil Sections: Common or individual, insulated, galvanized-steel casings.
2. Heating Coil: Hot water.

3. Cooling Coil: Chilled water.
4. Water Coils:
 - a. Tubes: Copper.
 - b. Fins: Aluminum.
 - c. Frames: Galvanized steel.
5. Steam Coils: Distribution header type.
 - a. Tubes: Copper.
 - b. Fins: Aluminum.
 - c. Frames: Galvanized steel.

E. Prefilters:

1. Extended-surface, disposable panel.

F. Filters:

1. Extended-surface, disposable panel.

G. Filter gages.

H. Dampers:

1. Leakage Rate: Not to exceed 2 percent at 2000-fpm (10-m/s) face velocity and 4-inch wg (1000-Pa) pressure differential; AMCA 500.
2. Damper Operators: Electronic.
3. Low-Leakage, Outside-Air Dampers: Double skin, airfoil blade, galvanized steel.
4. Mixing Boxes: Parallel blade, galvanized steel.
5. Combination filter and mixing box.

1.4 INSTALLATION

- A. Equipment Mounting: Install air-handling units on concrete bases using restrained spring isolators.
- B. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers.

END OF SECTION 237313

SECTION 260513 - MEDIUM-VOLTAGE CABLES

1.1 SUMMARY

- A. Cables for medium-voltage electrical distribution systems.

1.2 QUALITY ASSURANCE

- A. Quality Standards: IEEE C2 and NFPA 70.

1.3 COMPONENTS

- A. Cables: Type MV105.
 - 1. Conductor: Copper.
 - 2. Conductor Stranding: Class B.
 - 3. Conductor Insulation: Ethylene-propylene rubber.
 - a. Voltage Rating: 15 kV.
 - b. Insulation Thickness: 133 percent.
 - 4. Shielding: Copper tape, helically applied.
 - 5. Cable Jacket: Sunlight-resistant PVC.
- B. Splice Kits: Combination tape and cold-shrink-rubber sleeve types.
- C. Solid Terminations:
 - 1. Shielded-Cable Terminations: Class 1, modular type.
- D. Separable insulated connectors with load-break cable terminators.
- E. Fault indicators.

1.4 SOURCE QUALITY CONTROL

- A. Cables: Tested and inspected according to ICEA S-97-682.

1.5 FIELD QUALITY CONTROL

- A. Testing: By Contractor.

END OF SECTION 260513

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1.1 SUMMARY

- A. Building wires, cables, connectors, splices, and terminations for wiring systems rated 600 V and less; and sleeves and sleeve seals for cables.
- B. See Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.
- C. See Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.

1.2 QUALITY ASSURANCE

- A. Quality Standard: NFPA 70.

1.3 MATERIALS

- A. Conductors and Cables:
 - 1. Conductors: Copper.
 - 2. Conductor Insulation: Types THHN-THWN.
- B. Connectors and Splices: Factory fabricated.
- C. Sleeves for Raceways and Cables:
 - 1. Steel pipe sleeves.
- D. Sleeve Seals: EPDM sealing elements, stainless-steel pressure plates, and stainless-steel connecting bolts and nuts.

1.4 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper.

1.5 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; metal-clad cable, type ML is allowed, but homeruns must be routed in raceway.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- I. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- K. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- L. Class 2 Control Circuits: Type THHN-THWN, in raceway.

1.6 FIELD QUALITY CONTROL

- A. Testing: By Contractor.
- B. Infrared Scanning: For each splice in cables and conductors No. 3 AWG and larger.

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

1.1 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL with a field supervisor certified by BICSI as an RCDD.

1.2 PRODUCTS

- A. Pathways:

- 1. Open Cabling: Support brackets with cable tie slots, lacing bars, spools, J-hooks, and D-rings.
 - 2. Cable Trays: Metal, suitable for indoors, protected against corrosion by electroplated zinc galvanizing.
 - a. Basket cable trays.
 - 3. Conduit and boxes.

- B. Backboards: Plywood, fire-retardant treated.

- C. UTP Cable: 100 ohm, four pair, plenum rated.

- 1. Connecting Blocks: 110-style IDC for Category 6.

- D. Optical Fiber Cable: Multimode, 50/125 micrometer, 12 fiber, nonconductive, tight buffer.

- 1. Connectors: Simplex and duplex, Type SC.

- E. RS-232 Cable: Plenum rated, Type CMP, two pair, No. 22 AWG, stranded copper; each pair 100 percent shielded, copper drain wire.

- F. RS-485 Cable: Plenum rated, Type CMP, two twisted pair, No. 22 AWG, stranded copper, unshielded.

- G. Low-Voltage Control Cable:

- 1. Paired Cable: No. 16 AWG, plenum-rated, Type CMP, twisted pair.
 - 2. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway.
 - 3. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway.
 - 4. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF.

- H. Identification products.

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1.3 INSTALLATION

- A. Wiring Method: In raceways or cable tray.
- B. Remove abandoned conductors and cables.

1.4 FIELD QUALITY CONTROL

- A. Testing: By Contractor.

END OF SECTION 260523

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

1.1 MATERIALS

- A. Sleeves:
 - 1. PVC-coated or wrapped rigid steel.
- B. Sleeve-Seals:
 - 1. EPDM rubber sealing elements.
 - 2. Carbon-steel pressure plates.
 - 3. Carbon-steel, with corrosion-resistant coating, connecting bolts and nuts.
- C. Hydraulic-cement grout.
- D. Silicone Sealants:
 - 1. Single-component, silicone-based, neutral-curing elastomeric sealant.
 - 2. Multicomponent, silicone-based liquid elastomeric nonshrinking foam.

END OF SECTION 260544

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

1.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading: Consultant Structural Engineer.

1.2 PRODUCTS

- A. Vibration Isolators:
 - 1. Restrained spring isolators.
- B. Seismic-Restraint Devices:
 - 1. Channel support systems.
 - 2. Galvanized restraint cables.
 - 3. Steel tube or steel slotted-support-system sleeve with internally bolted connections hanger rod stiffeners.
 - 4. Bushings for floor-mounted equipment anchors.
 - 5. Bushing assemblies for wall-mounted equipment anchorage.
 - 6. Resilient isolation washers and bushings.
 - 7. Mechanical anchors.
 - 8. Adhesive anchors.
- C. Factory Finishes: Standard.

1.3 FIELD QUALITY CONTROL

- A. Testing: By Contractor.

END OF SECTION 260548

SECTION 261200 - MEDIUM-VOLTAGE TRANSFORMERS

1.1 SUMMARY

- A. Pad-mounted, liquid-filled transformers.

1.2 QUALITY ASSURANCE

- A. Quality Standards: ANSI C57.12.10, ANSI C57.12.28, IEEE C57.12.70, and IEEE C57.12.80.

1.3 PRODUCTS

- A. Pad-Mounted, Liquid-Filled Transformers: Two-winding type with stainless-steel tank base and cabinet.
 - 1. Insulating Liquid: Less flammable, edible-seed-oil based.
 - 2. Insulation Temperature Rise: 55 deg C with operated at rated kVA output in a 40 deg C ambient temperature.
 - 3. Basic Impulse Level: 95 kV.
 - 4. Full-Capacity Voltage Taps: Four nominal 2.5 percent taps, 2 above and 2 below rated primary voltage.
 - 5. High-Voltage Switch: 200 A, arranged for radial feed.
 - 6. Primary Fuses: 150-kV fuse assembly, Bay-O-Net liquid-immersed current-limiting fuses.
 - 7. Surge Arresters: Three arresters for radial-feed circuits.
 - 8. High-Voltage Terminations and Equipment: Dead front with universal-type bushing wells.
 - 9. Accessories:
 - a. Drain valve.
 - b. Dial-type thermometer.
 - c. Liquid-level gage.
 - d. Pressure-vacuum gage.
 - e. Pressure relief device.
 - f. Mounting provisions for low-voltage current and potential transformers.
 - g. Busway terminal connection.
 - h. Alarm contacts for gages and thermometers.

1.4 SOURCE QUALITY CONTROL

- A. Transformers: Tested and inspected according to IEEE C57.12.90 and IEEE C57.12.91.

1.5 INSTALLATION

- A. Transformers mounted on concrete bases, 4 inches (100 mm) high.

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1.6 FIELD QUALITY CONTROL

- A. Testing: By Contractor.
- B. Voltage Monitoring and Adjustment: One time within six months after Final Acceptance.

END OF SECTION 261200

SECTION 261300 - MEDIUM-VOLTAGE SWITCHGEAR

1.1 SUMMARY

- A. Metal-enclosed interrupter switchgear.

1.2 QUALITY ASSURANCE

- A. Quality Standards: IEEE C2 and IEEE C37.20.1.

1.3 MANUFACTURED UNITS

- A. System Voltage: 14.4 kV nominal; 15 kV maximum.
- B. Metal-Enclosed Interrupter Switchgear:
 - 1. Arc resistant, Type 2C.
 - 2. Main-Bus Continuous Rating: 600 A.
 - 3. Interrupter Switches, Duty-Cycle, Fault Closing: 14,000 asymmetrical A.
 - 4. Mechanical interlock to prevent opening door unless switchblades are open.
 - 5. Window to permit viewing switchblade position.
 - 6. Power fuses.
- C. Outdoor Enclosure: Galvanized steel.
- D. Components:
 - 1. Main Bus: Copper, silver plated at connection points.
 - 2. Ground bus.
 - 3. Bus insulation.
 - 4. Surge arresters.
 - 5. Provision for future devices.
 - 6. Fungus proofing.

1.4 SOURCE QUALITY CONTROL

- A. Circuit Breakers: Tested according to ANSI C37.09.
- B. Switchgear Assembly: Tested according to IEEE C37.20.2.

1.5 FIELD QUALITY CONTROL

- A. Testing: By Contractor.

END OF SECTION 261300

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

1.1 SUMMARY

- A. Dry-type, distribution transformers rated 600 V and less, with capacities up to 1000 kVA.

1.2 QUALITY ASSURANCE

- A. Quality Standard: IEEE C57.12.91.

1.3 PRODUCTS

- A. General Transformer Requirements:

- 1. Factory assembled and tested; air cooled.
- 2. Cores: Grain-oriented, non-aging silicon steel.
- 3. Coils: Copper, continuous windings without splices except for taps.

- B. Distribution Transformers: NEMA ST 20.

- 1. Core: One leg per phase.
- 2. Enclosure:
 - a. Ventilated.
 - b. NEMA 250, Type 2.
- 3. Custom Finish: Gray.
- 4. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- 5. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- 6. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- 7. Insulation Class: 220 deg C, with maximum 150 deg C rise above 40 deg C.
- 8. Features:
 - a. Energy efficient for transformers larger than 15 kVA.
 - b. K-factor rating.
 - c. Electrostatic shielding.
 - d. Wall brackets.
 - e. Fungus proofing.
 - f. Low sound level.

1.4 SOURCE QUALITY CONTROL

- A. Transformers: Tested and inspected according to IEEE C57.12.91.

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Ogden, Utah

1.5 FIELD QUALITY CONTROL

A. Testing: By Contractor.

B. Test Procedure:

1. Visual and mechanical inspections and electrical tests.
2. Infrared scanning.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

1.1 QUALITY ASSURANCE

- A. Quality Standards: NEMA PB 2, NFPA 70, and UL 891.

1.2 PRODUCTS

A. Manufactured Units:

1. Front-connected, front-accessible switchboards.
 - a. Main Devices: Panel mounted.
 - b. Branch Devices: Panel mounted.
 - c. Sections front and rear aligned.
2. Nominal System Voltage: 480Y/277 V.
3. Main-Bus Continuous: As determined by the design-build contractor.
4. Constructed to withstand seismic forces.
5. Indoor Enclosures: Steel, NEMA 250, Type 1.
 - a. Finish: Standard gray color.
6. Barriers: Between adjacent switchboard sections.
7. Insulation and Isolation: Main bus of main section and main and vertical buses of feeder sections.
8. Cubical space heaters.
9. Utility metering compartment.
10. Customer metering compartment.
11. Bus transition and incoming pull sections.
12. Removable, hinged rear doors and compartment covers.
13. Hinged front panels.
14. Pull box on top of switchboard.
15. Buses and Connections: Three phase, four wire; copper.
16. Future device provisions.
17. Bus-bar insulation.
18. Fungus proofing.

- B. Transient Voltage Suppression Devices: Integrally mounted, wired-in, solid-state, parallel-connected, modular-type, with sine-wave tracking suppression and filtering modules, short-circuit current rating matching or exceeding the switchboard short-circuit rating.

1. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
2. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
3. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277-V, three-phase, four-wire circuits shall be as follows:

- a. Line to Neutral: 800 V for 480Y/277.
 - b. Line to Ground: 800 V for 480Y/277.
 - c. Neutral to Ground: 800 V for 480Y/277.
- 4. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
 - a. Line to Neutral: 400 V, 800 V from high leg.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
- 5. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
 - a. Line to Line: 2000 V for 480 V.
 - b. Line to Ground: 1500 V for 480 V].
- C. Disconnecting and Overcurrent Protective Devices:
 - 1. Branch feeder devices: Molded-case circuit breaker (MCCB), with interrupting capacity to meet available fault currents.
 - a. Thermal-magnetic circuit breakers.
 - b. Adjustable instantaneous-trip circuit breakers.
 - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and field-adjustable settings.
 - d. Accessories:
 - 1) Lugs: Mechanical style.
 - 2) Ground-Fault Protection: Integrally mounted, if required.
 - 2. Main Device: Insulated-Case Circuit Breaker (ICCB): 80 percent rated, fixed mounting.
 - a. Two-step, stored-energy closing.
 - b. Standard-function microprocessor-based trip units.
- D. Instrumentation:
 - 1. Instrument Transformers:
 - a. Potential transformers.
 - b. Current transformers.
 - c. Control-power transformers.
 - d. Current transformers for neutral and ground-fault current sensing.
 - 2. Multifunction digital-metering monitor.
 - 3. Impulse-totalizing demand meter.
- E. Accessories:
 - 1. Accessory set including tools.

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Ogden, Utah

2. Portable test set.
3. Spare-fuse cabinet.

F. Identification:

1. Service equipment label.

1.3 FIELD QUALITY CONTROL

- A. Testing: By Contractor.
- B. Tests: Infrared scanning.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

1.1 QUALITY ASSURANCE

- A. Quality Standards: NEMA PB 1 and NFPA 70.

1.2 PRODUCTS

A. General Requirements for Panelboards:

1. Constructed to withstand seismic forces.
2. Enclosures: Flush and surface mounted.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Wash-Down Areas: NEMA 250 stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - f. Front: Hinged cover.
 - g. Directory card.
3. Incoming Mains Location: Top and bottom.
4. Phase, Neutral, and Ground Buses: Copper.
 - a. Optional Buses: Equipment ground, isolated ground, and extra-capacity neutral.
5. Conductor Connectors: Mechanical-type main and neutral lugs.
 - a. Optional Features: Mechanical-type feed-through lugs, sub-feed lugs, and extra-capacity neutral lugs, as required by the application.
6. Service equipment label for panelboards incorporating one or more main service disconnecting and overcurrent protective devices.
7. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

B. Distribution Panelboards:

1. Mains: Circuit breaker or Lugs, only.
2. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
3. Fused switches.

C. Lighting and Appliance Branch-Circuit Panelboards:

1. Mains: Circuit breaker or lugs, only, as required by the application.
2. Branch Overcurrent Protective Devices: Bolt-on circuit-breaker type.

D. Disconnecting and Overcurrent Protective Devices:

1. Molded-Case Circuit Breaker: Interrupting capacity to meet available fault currents.
 - a. Circuit Breakers: Thermal-magnetic type.
 - b. Features and Accessories:
 - 1) Lugs: Mechanical style.
 - 2) Appropriate for Application: Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
2. Fused Switch: NEMA KS 1, Type HD.
 - a. Auxiliary contacts.

E. Panelboard Suppressors: Integrally mounted, wired-in, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating.

1. Accessories:
 - a. Fuses rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 - c. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - d. LED indicator lights for power and protection status.
 - e. Audible alarm, with silencing switch, to indicate when protection has failed.
 - f. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation.
2. Peak Single-Impulse Surge Current Rating: 80kA per mode/160kA per phase.
3. Minimum Single-Impulse Current Ratings, Using 8-by-20-Mic.Sec. Waveform:
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
5. Protection modes and UL 1449 SVR for Grounded Wye Circuits with 480Y/277-V, 208Y/120-V, Three-Phase, Four-Wire Circuits:
 - a. Line to Neutral: 800 V for 480Y/277, 400 V for 208Y/120.
 - b. Line to Ground: 800 V for 480Y/277, 400 V for 208Y/120.
 - c. Neutral to Ground: 800 V for 480Y/277, 400 V for 208Y/120.

F. Accessories:

1. Accessory set including tools.

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Ogden, Utah

2. Portable test set.

1.3 FIELD QUALITY CONTROL

A. Testing: By Contractor.

B. Tests: Infrared scanning.

1.4 ADJUSTING

A. Load balancing.

END OF SECTION 262416

SECTION 262419 - MOTOR-CONTROL CENTERS

1.1 PRODUCTS

A. Modular Compartmental Arrangement:

1. Combination controller units.
2. Feeder-tap units.
3. Future units.
4. Spare units.

B. Incoming Mains: Located on top and bottom, as required by the application.

1. Main Lugs Only: Hard-drawn copper, 98 percent conductivity with mechanical-type lugs.

C. Combination Controllers:

1. Full-Voltage Controllers: Nonreversing.
2. MCPs.
3. Solid-state overload relays with phase-failure, phase-reveral, and under-voltage and over-voltage protection.
4. Control Power: 24-V ac; obtained from integral CPT, with primary and secondary fuses.

D. Feeder-tap units.

E. Enclosures:

1. Indoor enclosures.

F. Auxiliary Devices:

1. Push-button stations, pilot lights, and selector switches.
2. Contactor auxiliary contacts.

1.2 FIELD QUALITY CONTROL

A. Testing: By Contractor.

END OF SECTION 262419

SECTION 262913 - ENCLOSED CONTROLLERS

1.1 PRODUCTS

A. Full-Voltage Controllers:

1. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; nonreversing.
2. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; nonreversing.
3. Magnetic Controller: Full voltage, electrically held.
 - a. Configuration: Nonreversing.
 - b. Control Circuit: 24-V ac, integral CPT, with primary and secondary fuses; CPT control power source with 200 VA spare capacity.
 - c. Overload Relay: Solid state.
4. Combination Magnetic Controller: MCP disconnecting means, and with auxiliary contacts.

B. Enclosures: NEMA ICS 6.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.
3. Wash-Down Areas: stainless steel.
4. Other Wet or Damp Indoor Locations: Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

C. Accessories:

1. Push Buttons: Recessed types; momentary as indicated.
2. Pilot Lights: LED types; colors as indicated; push to test.
3. Selector Switches: Rotary type.
4. Contactor auxiliary contact(s).
5. Auxiliary and adjustable solid-state time-delay relays.
6. Solid-state, phase-failure, phase-reversal, and undervoltage and overvoltage relays.
7. Spare control wiring terminal blocks.

1.2 FIELD QUALITY CONTROL

A. Testing: By Contractor.

END OF SECTION 262913

SECTION 263213 - ENGINE GENERATORS

1.1 SUMMARY

- A. Packaged diesel-engine generator sets.

1.2 QUALITY ASSURANCE

- A. Quality Standard: NEMA MG 1 and NFPA 37.
- B. Emergency Power Supply System: NFPA 110, Level 1.
- C. Safety Standard: ASME B15.1.

1.3 PROJECT CONDITIONS

- A. Environmental Conditions: Minus 15 to 40 deg C and 5000 feet (1524 m) altitude.

1.4 WARRANTY

- A. Materials and Workmanship: Five years.

1.5 MAINTENANCE SERVICE

- A. Full-Maintenance Service: 12 months.

1.6 ENGINE-GENERATOR SET

- A. Output Connections: Three-phase, four wire.
- B. Performance: Suitable for loads involving sensitive electronic equipment, adjustable frequency drives, or uninterruptible power supply systems.
- C. Fuel: Fuel oil, Grade DF-2.
- D. Governor: Adjustable isochronous, with speed sensing.
- E. Engine Cooling System: Integral radiator with expansion tank.
- F. Fuel Oil Storage:
 - 1. Base-Mounted Fuel Oil Tank: Capacity for 24 hours' operation.
- G. Engine Exhaust System: Residential-type muffler.

- H. Combustion-Air Intake: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element.
- I. Starting System: Electric motor, 12 V, with battery and battery charger.
- J. Control and Monitoring: Automatic starting; with control devices grouped on panel mounted on generator set.
 - 1. Connection to data link for building automation system or building monitoring and control system.
 - 2. Common remote audible alarm.
 - 3. Remote alarm annunciator.
- K. Generator Overcurrent and Fault Protection:
 - 1. Microprocessor-based generator protector.
- L. Generator: Directly connected to engine shaft, with dripproof enclosure and solid-state voltage regulator.
- M. Outdoor Generator-Set Enclosure: Vandal-resistant, weatherproof steel housing.

1.7 SOURCE QUALITY CONTROL

- A. Testing: Prototype at factory.

1.8 INSTALLATION

- A. Mounting: On concrete base with restrained-spring vibration isolators.

1.9 FIELD QUALITY CONTROL

- A. Testing: By Contractor.

END OF SECTION 263213

SECTION 263323 - CENTRAL BATTERY EQUIPMENT

1.1 SUMMARY

- A. Slow-transfer central battery inverters.

1.2 QUALITY ASSURANCE

- A. Quality Standards: UL 924 and UL 1778.

1.3 WARRANTY

- A. Materials or Workmanship for Batteries:
 - 1. Standard, Recombinant, Lead Calcium: One-year full warranty and nine years pro rata.

1.4 PRODUCTS

- A. Inverter Performance Requirements:
 - 1. Slow-Transfer Central Battery Inverters: Electromechanical switch to transfer loads in one second or less.
- B. Inverter: Solid-state type.
 - 1. Output Voltage: Plus/minus 5 percent.
 - 2. Output Frequency: Plus/minus 1 Hz.
 - 3. Output Waveform: Sine wave with maximum of 10 percent THD.
 - 4. Output Protection: Current-limiting and short-circuit protection.
 - 5. Surge Protection: Panelboard suppressors.
 - 6. Optional Features:
 - a. Overload Capability: 125 percent for 10 minutes; 150 percent surge.
 - b. Brownout protection.
- C. Battery Charger: Solid-state type.
- D. Batteries: Standard, recombinant, lead calcium.
 - 1. Full-capacity output of 90 minutes.
- E. Enclosures: NEMA 250, Type 1.
- F. Seismic restraints.
- G. Control and Indication: Common control panel on front of enclosure.

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Ogden, Utah

1. Dry-form "C" contacts for remote indication.
2. Enclosure: Steel, with lockable doors; floor mounting.

H. Optional Features:

1. Multiple output voltages.
2. Emergency-only circuits.

I. Output Distribution Section: Panelboard integral to equipment cabinet.

J. System Monitoring and Alarms:

1. Remote status and alarm panel.
2. Provisions for remote computer monitoring.
3. Battery ground-fault detector.
4. Battery-cycle warranty monitoring.

1.5 SOURCE QUALITY CONTROL

- A. Inverter System, Including Battery: Factory tested before shipment.

1.6 FIELD QUALITY CONTROL

- A. Testing: By Contractor.

END OF SECTION 263323

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

1.1 MATERIALS

A. Sleeves:

1. Schedule 40 steel pipe.
2. Molded-PVC pipe.

B. Sleeve-Seals:

1. EPDM rubber sealing elements.

C. Hydraulic-cement grout.

D. Silicone Sealants:

1. Single-component, silicone-based, neutral-curing elastomeric sealant.
2. Multicomponent, silicone-based, liquid elastomeric nonshrinking foam.

END OF SECTION 270544

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

1.1 SUMMARY

- A. Telecommunications mounting equipment, service entrance pathways, and grounding.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Layout, supervision, and inspection by BICSI-registered personnel.
- B. Electrical Components: Listed and labeled according to NFPA 70.
- C. Quality Standards:
 - 1. For Telecommunications Pathways and Spaces: TIA/EIA-569-A.
 - 2. Grounding: ANSI-J-STD-607-A.

1.4 MATERIALS

- A. Cable Supports: Fire-resistant support brackets, lacing bars, spools, J-hooks, and D-rings.
- B. Cable Trays: Metal, electroplated zinc galvanizing.
 - 1. Basket cable trays.
- C. Backboards: Plywood, fire-retardant treated.
- D. Equipment Frames: Steel.
 - 1. Floor-mounted racks.
- E. Power Strips: 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles; close-coupled, direct plug-inline cord; and 33 kA peak single-impulse surge current rating per phase.
- F. Grounding Connectors: Solderless compression type.
- G. Labeling: Comply with TIA/EIA-606-A and UL 969.

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1.5 ENTRANCE FACILITIES

- A. Underground pathways.

1.6 INSTALLATION

- A. Identification: Preprinted or computer-printed labels for Class 4 level of administration, including optional identification.

END OF SECTION 271100

SECTION 271300 - COMMUNICATIONS BACKBONE CABLING

1.1 PERFORMANCE REQUIREMENTS

- A. Transmission Standards: TIA/EIA-568-B.1.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: BICSI certified as an RCDD.
- B. Testing Agency Qualifications: An NRTL with a field supervisor certified by BICSI as an RCDD.
- C. Quality Standards:
 - 1. For Telecommunications Pathways and Spaces: TIA/EIA-569-A.
 - 2. Grounding: ANSI-J-STD-607-A.
- D. Products: NRTL listed and labeled.

1.3 MATERIALS

- A. Cable Supports: Support brackets, lacing bars, spools, J-hooks, and D-rings.
- B. Cable Trays: Metal, electroplated zinc galvanized.
 - 1. Basket cable trays.
- C. Conduit and boxes. Flexible metal conduit shall not be used.
- D. Backboards: Plywood, fire-retardant treated.
- E. Optical Fiber Cabling: Multimode, 50/125-micrometer, 12-fiber, nonconductive, tight buffer.
 - 1. Connectors: Simplex and duplex, Type SC connectors. Type SFF connectors may be used in termination racks, panels, and equipment packages.

1.4 INSTALLATION

- A. Wiring Method: In raceways.
- B. Identification: TIA/EIA-606 Class 4 level of administration including optional identification requirements of this standard.

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1.5 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency.

END OF SECTION 271300

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

1.1 PERFORMANCE REQUIREMENTS

- A. Transmission Standards: TIA/EIA-568-B.1.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: BICSI certified as an RCDD.
- B. Testing Agency Qualifications: An NRTL with a field supervisor certified by BICSI as an RCDD.
- C. Quality Standards:
 - 1. For Telecommunications Pathways and Spaces: TIA/EIA-569-A.
 - 2. Grounding: ANSI-J-STD-607-A.
- D. Products: NRTL listed and labeled.

1.3 MATERIALS

- A. Cable Supports: Support brackets, lacing bars, spools, J-hooks, and D-rings.
- B. Cable Trays: Metal, hot-dip galvanized.
 - 1. Basket cable trays.
- C. Backboards: Plywood, fire-retardant treated.
- D. UTP Cabling: 100-ohm, 4-pair cable, plenum-rated.
 - 1. Connecting Blocks: 110-style IDC for Category 6.
 - 2. Jacks and Jack Assemblies: Eight-position modular.
 - 3. 48-inch 1200-mm patch cords.
- E. Coaxial Cabling: No. 16, RG-6/U, Type CATV or CM, plenum-rated, broadband, 75-ohm cable with BNC connectors.
- F. Twisted-Pair Telecommunications Outlet/Connectors: Four-pair, eight-position modular.
- G. Workstation Outlets: Three-port-connector assemblies mounted in single faceplate.
- H. Cable Management System: Computer-based cable management system, with integrated database and graphic capabilities. Direct download circuit labeling into labeling printer.

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Health Technology Building
Ogden, Utah

1.4 INSTALLATION

- A. Wiring Method: In raceway or cable tray.
- B. Identification: TIA/EIA-606 Class 4 level of administration including optional identification requirements of this standard.

1.5 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency.

END OF SECTION 271500

SECTION 274133 - MASTER ANTENNA TELEVISION SYSTEM

1.1 SYSTEM DESCRIPTION

- A. Direct broadcast satellite service, an off-air antenna system and a coaxial cable distribution system.

1.2 QUALITY ASSURANCE

- A. Quality Standard: NFPA 70.

1.3 PRODUCTS

- A. Systems Requirements:
 - 1. Components: Plug-in, modular, heavy-duty, industrial- or commercial-grade units.
 - 2. Equipment: Silicon-based, solid-state, integrated circuit devices.
 - 3. Power Supply Characteristics: Supply voltage range of 105 to 130 V ac.
 - 4. Transient-voltage protection for signal cables and connected components.
 - 5. RF and video impedance matching.
- B. MATV Equipment: Signal-source components, signal-processing and amplifying equipment, distribution components, and interconnecting wiring.
- C. Off-Air, Mast-Mounted Antennas: Weatherproof single-channel or broadband type, anodized aluminum, and rated for 100-mph (160-km/h) wind, minimum.
 - 1. CEA Reception Patterns: Per campus requirements.
 - 2. FM Antenna: Omnidirectional.
 - 3. Antenna-Supporting Structures: Adequate to withstand 100-mph (160-km/h) winds.
- D. Headend Components:
 - 1. Directional coupler antenna combiner.
 - 2. Antenna mast-mounted preamplifier.
 - 3. Channel mixers.
 - 4. Processor for each channel to be translated.
 - 5. Broadband amplifier.
 - 6. Single-channel amplifiers.
 - 7. FM module.
 - 8. Combining network (mixer).
- E. Distribution Components:
 - 1. Signal power splitters and isolation taps.
 - 2. Distribution system amplifiers.
 - 3. Cable system power supplies.

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Ogden, Utah

4. Signal traps.
5. Attenuators.
6. Terminating resistors.
7. User-Interface Devices: Flush, female-type outlets. Feed-through-type cable connection shall not be used.

F. Enclosures.

END OF SECTION 274133

SECTION 275313 - CLOCK SYSTEMS

1.1 SUMMARY

- A. Master clock control system with the following:
 - 1. Secondary indicating clocks.

1.2 PRODUCTS

- A. Secondary Indicating Clocks:
 - 1. Digital Clock: Display height of 4 inches (102 mm), with display selectable between 12-hour with "PM" format and 24-hour format.
 - a. Connections for Power and Correction: Plug connector power connection for secondary indicating clocks.
 - b. Provision for time-tone unit installation.
 - c. Face Configurations: Single.
 - d. Mounting: Recessed.
- B. Back boxes for secondary indicating clocks and program devices.
- C. Conductors and Cables: Insulated copper.
 - 1. 120-V AC : Soup single conductor.

1.3 INSTALLATION

- A. Wiring Method: In raceways.

END OF SECTION 275313

SECTION 284000 – SOUND SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes equipment for amplifying, distributing, and reproducing sound signals.

1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Comply with UL 50.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. System Functions: Include the following:
 - 1. Selectively connecting separate zones to different signal channels.
 - 2. Selectively amplifying sound among various microphone outlets and other inputs.
 - 3. Communicating simultaneously to all zones regardless of zone or channel switch settings.
 - 4. Producing a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 - 5. Reproducing high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; and output free of non-uniform coverage of amplified sound.
 - 6. Refer to Electrical Narrative for specific requirements.

2.2 EQUIPMENT AND MATERIALS

- A. Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Modular type using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring Method:

1. Install wiring in raceways and cable trays except within consoles, cabinets, desk, and counters and except in accessible suspended ceiling spaces. Where cables are routed in accessible suspended ceilings, secure and support cables with J-hooks at intervals not exceeding 30 inches (760 mm). Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Use UL-listed plenum cable throughout the entire system.
2. Conceal raceway and cables except in unfinished spaces.
3. In open ceilings and unfinished spaces, install wiring in exposed raceway.
4. At racks in communication rooms, secure and support cables at not more than 6 inches (150 mm) from cabinets, fittings, outlets, racks, frames, and terminals.
5. Cable trays are specified in Division 16 Section "Raceway Systems". Raceways are specified in Division 16 Section "Conduit Raceways". Electrical Boxes and fitting are specified in Division 16 Section "Electrical Boxes and Fittings".

3.2 FIELD QUALITY CONTROL

A. Testing: By Contractor

END OF SECTION 16762

SECTION 311000 - SITE CLEARING

1.1 SUMMARY

- A. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.
- B. Removing existing trees, shrubs, groundcovers, plants, and grass.
- C. Clearing and grubbing obstructions, trees, shrubs, grass, and other vegetation including grinding stumps and removing roots and debris.
- D. Stripping and stockpiling topsoil and stockpiling surplus topsoil.
- E. Removing existing above- and below-grade site improvements.
- F. Disconnecting, capping or sealing, and removing site utilities.
- G. Providing temporary erosion and sedimentation control measures.

END OF SECTION 311000

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes trimming, protection, and irrigation of trees and vegetation that are to remain. Trees which are to remain and must be protected are indicated on the drawings.

1.2 SUBMITTALS

- A. Certification: Submit written statement from an Arborist certified by the International Society of Arboriculture that trees and vegetation to remain have been protected during the course of construction in accordance with recognized standards and that where damage did occur; trees were promptly and properly treated. Indicate which damaged trees (if any) are incapable of retaining full growth potential and are recommended to be replaced.
- B. Tree Protection Plan: Contractor to submit a 'Tree Protection Plan' for approval by the Owner's Authorized Representative prior to beginning construction. The tree protection plan may include fencing, barricades, temporary irrigation, employee education, etc.

1.3 QUALITY ASSURANCE

- A. Arborist Qualifications: Engage an Arborist certified by the International Society of Arboriculture who has successfully completed tree protection and trimming to perform the following work:
 - 1. Remove branches from trees that are to remain, if required.
 - 2. Recommend procedures to compensate for loss of roots and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.
 - 3. Recommend procedures for excavation and grading work juxtaposed to established plants.
 - 4. Perform tree repair work for damage incurred by new construction.

1.4 PROJECT CONDITIONS

- A. Temporary Protections: Provide fencing located outside drip-line (outer perimeter of branches) to protect trees and other plants that are to remain from damage for any tree within one hundred feet of construction activity.
 - 1. Tree protection fence that is protecting trees on adjoining properties needs only be on this project site and not on the adjoining property unless otherwise noted.
- B. Protect Root Systems: Do not store construction materials, debris, or excavated material within drip-line of trees to remain. Do not permit vehicles within drip line. Restrict foot traffic to prevent excessive compaction of soil over root systems within fenced area.
- C. Watering: Provide irrigation to landscape and trees to remain.

1.5 ARBORIST OBSERVATIONS:

- A. The certified arborist shall visit the site a minimum of once each month throughout the growing season to advise the Contractor and Owner's Authorized Representative of changes or modifications to the protection and maintenance procedures.
 - 1. The Arborist shall provide a Tree Monitoring Report for each site visit indicating tree damage, soil moisture/irrigation, color of foliage, canopy density, trunk and limb discoloration, and pest presence.
 - 2. The Arborist shall provide a Post-Construction Management Plan for the trees indicating tree assessments, fertilizing recommendations, and other long term maintenance recommendations.

PART 2 - MATERIALS:

2.1 FENCING:

- A. Tree protection fence shall be sturdy and highly visible to discourage entrance and disturbance.
 - 1. Fence to be 4 ft high minimum.
 - 2. Fence to be constructed using heavy posts using heavy wire between posts.
 - 3. Signage – fencing shall be signed indicating the fence as a tree protection fence with the contractor and arborist contact information.

2.2 TEMPORARY IRRIGATION

- A. Polyethylene pipe, fittings, risers, nozzles, and valve(s) as needed to ensure proper application. Temporary irrigation system shall be connected to an automatic controller.

2.3 ROOT PROTECTION MULCH

- A. Temporary construction within the tree protection fence requires additional root protection from soil compaction and mechanical root damage. Methods of protection to be determined by the Certified Arborist. Methods may include;
 - 1. Apply 4 inches of woodchip mulch to the area.
 - 2. Use ¾ inch plywood
 - 3. Use large wood beams
 - 4. Use 4 inches of gravel mulch over a landscape fabric
 - 5. Use commercial road mats
- B. Temporary methods of root protection to be removed and the tree protection fence re-installed as soon as construction activity near the tree is completed.

PART 3 - EXECUTION

3.1 GENERAL

- A. Protect tree root systems from damage due to noxious materials caused by run-off or spillage during mixing, placement, or storage of construction materials. Protect root systems from flooding, eroding, or excessive wetting resulting from dewatering operations.
- B. Do NOT allow fires under or adjacent to trees or other plants that are to remain.

- C. Remove branches from trees that are to remain, if required, to clear new construction.
 - 1. Where directed by Owner's Authorized Representative and Arborist, extend pruning operation to restore natural shape of entire tree.
 - 2. Cut branches and roots, if required, with sharp pruning instruments; do not break or chop.
- D. Watering: Water trees with temporary irrigation system at a rate to allow each tree to receive adequate water as directed by the Certified Arborist.
 - 1. Irrigation system to the trees and landscaping shall be operated by the existing automatic controller.
 - 2. Provide temporary irrigation to landscape and trees to remain if irrigation systems are not in operation.
 - 3. Irrigation water should penetrate the soil to a depth of 18 inches with a minimum of 1 inch of irrigation water weekly in the absence of rainfall.

3.2 EXCAVATION AROUND TREES

- A. Excavate within proximity of trees only where indicated. Do not machine excavate within drip line.
- B. Where excavating for new construction is required within drip line of trees, hand excavate to minimize damage to root systems. Provide sheeting at excavations if required. Use narrow-tine spading forks and comb soil to expose roots.
 - 1. Relocate roots in backfill areas wherever possible. If large, main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches back from new construction.
- C. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth.
- D. Where trenching for utilities is required within drip line, tunnel under or around roots by hand digging. Do not cut main lateral roots or tap roots; cut only smaller roots that interfere with installation of new work. Cut roots with sharp pruning instruments; do not break or chop.
- E. Prune branches to balance loss to root system caused by damage or cutting of roots.

3.3 GRADING AND FILLING AROUND TREES

- A. Maintain existing grade within drip line of trees.
- B. Lowering Grades: Where existing grade is above new finish grade shown around trees, gradually slope grade away from trees as recommended by arborist. Do not reduce grade within drip line.
 - 1. Prune branches to stimulate root growth and to compensate for loss of roots. Provide subsequent maintenance during the contract period as recommended by arborist. Provide

Owner with typed instructions for recommended long-range maintenance procedures to be followed after completion of construction operations.

3.4 RAISING GRADES:

- A. Minor Fills: Where existing grade is 6 inches or less below elevation of finish grade shown, use topsoil fill material specified. Place in single layer and do not compact; hand grade to required finish elevations. Do not place soil material against trunk of tree.

3.5 REPAIR AND REPLACEMENT OF TREES

- A. Repair trees damaged by construction operations. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees.
- B. If a tree is damaged, the Arborist and Owner's Authorized Representative shall determine if the tree can be restored to normal growth pattern. When it is determined that a tree cannot be restored, the following shall occur:
 - 1. Provide a new tree of the same size and species as those being replaced. Plant and maintain in accordance with current horticultural requirements.
 - 2. If trees over 6 inches in caliper measurement (taken 12 inches above grade) are required to be replaced, provide new trees with 6-inch caliper size and of species selected by the Owner.
 - 3. The contractor shall provide the Owner with a monetary compensation for trees over 6-inch caliper size. The monetary amount will be determined using the Trunk Formula Method of tree appraisal as outlined in the current Edition of the Guide for Plant Appraisal, The International Society of Arboriculture. The appraisal shall be performed by an independent Arborist certified by the International Society of Arboriculture who is experienced in this type of appraisal.

3.6 DISPOSAL

- A. Burning on Owner's property of removed trees and branches is not permitted on site.
- B. Removal from Owner's Property: Remove excess excavation, displaced trees, and trimmings in a legal manner at no additional expense to the Owner.

END OF SECTION 311300

SECTION 312000 - EARTH MOVING

1.1 SUMMARY

- A. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses and exterior plants.
- B. Dewatering to protect excavated subgrades.
- C. Excavating and backfilling or filling for buildings and structures, including footings and foundations, pile foundations, underground tanks, basins, and mechanical or electrical utility structures.
- D. Excavating and backfilling for utility trenches.
- E. Excavation: Unclassified.
- F. Grading.
- G. Subsurface drainage backfill for walls and trenches.
- H. Subbase course for concrete walks and pavements.
- I. Subbase and base course for hot-mix asphalt pavement.
- J. Drainage course for cast-in-place concrete slabs-on-grade.

1.2 MATERIALS

- A. Soil Materials:
 - 1. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GM, GP-GM, GW-GM, SM, SW. Maximum percentage passing #200 Sieve: 15%.
 - 2. Unsatisfactory Soils: ASTM D 2487 soil classification groups SC, SP, GP, CL, CH, PT, OH, OL, ML, MH.
 - 3. Backfill and Fill: Satisfactory soil materials.
 - 4. Subbase and Base Course: Natural or crushed gravel, crushed stone, and natural or crushed sand.
 - 5. Engineered Fill: Natural or crushed gravel, crushed stone, and natural or crushed sand.
 - 6. Bedding Course: Natural or crushed gravel, crushed stone, and natural or crushed sand.
 - 7. Drainage Course: Crushed stone, or crushed or uncrushed gravel.
 - 8. Filter Material: Natural or crushed gravel, or crushed stone and natural sand.
 - 9. Sand: Natural or manufactured.
 - 10. Impervious Fill: Clayey gravel and sand mixture.
- B. Geotextiles: Subsurface drainage and separation geotextile.
- C. Controlled low-strength material.

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Health Technology Building
Ogden, Utah

- D. Geofoam.
- E. Warning Tape: Detectable polyethylene film.

1.3 EXCAVATION

- A. Explosives: Not permitted.
- B. Disposal of Surplus and Waste Materials: Off Owner's property.

1.4 FIELD QUALITY CONTROL

- A. Geotechnical Testing Agency: Owner engaged.

END OF SECTION 312000

SECTION 312500 - EROSION AND SEDIMENTATION CONTROLS

1.1 SUMMARY

- A. Erosion control and slope protection facilities including blankets, fences, mulches, and dikes.
- B. Construction of drainage facilities to protect work areas.
- C. Temporary gravel driveway at the primary construction access to the site.
- D. Prepare Erosion Control Plans and Storm Water Pollution Prevention Plan and obtain State of Utah permits.

1.2 PRODUCTS

- A. Blankets and Mats: Biodegradable fabrics.
- B. Geotextiles and Geosynthetics: Filter fabrics, silt fences and soil stabilization products.
- C. Seed and Mulch: Hydromulch with an annual rye grass seed mix of three varieties.
- D. Gravel: 2-3 inch stone.

1.3 INSTALLATION

- A. Comply with Campus and government requirements for erosion and sedimentation controls.

END OF SECTION 312500

SECTION 321216 - ASPHALT PAVING

1.1 SUMMARY

- A. Cold milling of existing hot-mix asphalt pavement.
- B. Hot-mix asphalt patching, paving and paving overlay.
- C. Asphalt surface treatments.
- D. Pavement-marking paint.
- E. Traffic-calming devices.
- F. Imprinted asphalt.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements: Per UDOT and the DFCM Design Requirements section of the Design Manual dated May 25, 2005.

1.3 MATERIALS

- A. Asphalt Materials:
 - 1. Asphalt Binder: AASHTO M 320.
 - 2. Asphalt Cement: ASTM D3381; viscosity AC 10 for moderate climates.
 - 3. Prime Coat: Medium-curing cutback asphalt.
 - 4. Tack Coat: Emulsified asphalt or cationic emulsified asphalt.
 - 5. Fog Seal: Emulsified asphalt or cationic emulsified asphalt.
- B. Auxiliary Materials:
 - 1. Herbicide.
 - 2. Paving Geotextile: Nonwoven polypropylene.
 - 3. Pavement-Marking Paint: Alkyd-resin type.
 - 4. Wheel Stops: Precast concrete with galvanized-steel dowels.
- C. Preformed Traffic-Calming Devices: Speed bumps fabricated from solid, recycled plastic with galvanized-steel mounting hardware and adhesive.
- D. Imprinted Asphalt Materials:
 - 1. Pattern: Custom pattern indicated on Drawings.
 - 2. Coating System: Manufacturer's standard base coat and top coat in yellow color.
 - 3. Precut Marking Material: Reflectorized, thermoplastic pavement-marking pattern matching the imprinted pattern.
- E. Asphalt Mixes:

1. Base Course: 1" Gradation
2. Surface Course: 1/2" Gradation.

F. Asphalt Mixes: Designed according to AI MS-2.

1. Base Course: ASTM D 3515, 3/4-inch maximum aggregate size.
2. Surface Course: ASTM D 3515, 1/2-inch maximum aggregate size.

G. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

1.4 INSTALLATION

A. Cold Milling Existing Asphalt Pavement: Depth of 2 inches

B. Patching Hot-Mix Asphalt Pavement: Saw cut, excavate, apply tack coat, and fill with compacted hot-mix asphalt base mix for full thickness of patch.

C. Patching Portland Cement Concrete Pavement with Hot-Mix Asphalt is not allowed:

D. Repairs to Existing Pavements: Cracks and joints filled.

E. Hot-Mix Asphalt Paving:

1. Proof-roll subgrade at locations receiving full-depth asphalt pavement.
2. Apply herbicide.
3. Apply tack coat over existing hot-mix asphalt pavement and install paving geotextile over existing hot-mix asphalt pavement.
4. Base Course: 8" minimum or greater if recommended in a geotechnical report.
5. Surface Course: 3" or greater if recommended in a geotechnical report.

F. Asphalt curbs are not allowed.

G. Asphalt Traffic-Calming Devices: Speed bumps.

H. Surface Treatment: Slurry seal.

I. Imprinting Asphalt: Imprint in freshly laid asphalt.

1.5 FIELD QUALITY CONTROL

A. Testing: By owner.

END OF SECTION

SECTION 321313 - CONCRETE PAVING

1.1 SUMMARY

- A. Driveways and roadways.
- B. Parking lots.
- C. Curbs and gutters.
- D. Walkways.
- E. Unit paver base.

1.2 QUALITY ASSURANCE

- A. Design mixture for concrete.
- B. Quality Standard: ACI 301, "Specification for Structural Concrete."
- C. Mockups.

1.3 MATERIALS

- A. Reinforcement:
 - 1. Welded Wire Reinforcement: Plain steel.
 - 2. Reinforcing Bars and Tie Bars: Deformed steel.
 - 3. Steel bar mats.
 - 4. Synthetic Fiber: complying with ASTM C116, Type III.
- B. Concrete:
 - 1. Portland Cement: ASTM C 150.
 - 2. Aggregate: Normal-weight aggregate.
 - 3. Admixture: Air entraining.
 - 4. Compressive Strength: 4000 psi at 28 days for non-traffic loaded concrete, 5000 psi at 28 days for traffic loaded concrete pavement.
- C. Membrane-Forming Curing Compound: ASTM C309, Type I, liquid membrane.
- D. Related Materials:
 - 1. Expansion- and Isolation-Joint-Filler Strips: Cellulosic fiber.
 - 2. Color pigment.
 - 3. Pavement-Marking Paint: Alkyd resin.

- 4. Wheel Stops: Precast concrete.

1.4 FINISHING

- A. Finishes: Medium-to-coarse-textured broom finish.

1.5 FIELD QUALITY CONTROL

- A. Testing: By Owner-engaged agency.

END OF SECTION 321313

SECTION 328423 – IRRIGATION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. It is the intention of these specifications to accomplish the work of installing an irrigation system that will operate in an efficient and satisfactory manner according to the workmanlike standards established for the irrigation industry.
 - 1. As-built Irrigation Drawings: Prepare as-built drawings which shall show locations of the main line pipe, controller locations, remote control valves, and manual drain valves. The drawings shall indicate the materials and manufacturer's name and catalog number. The Owner's Authorized Representative will review the "as-builts" to verify that changes are being recorded as construction occurs.
 - 2. As-built Drawings shall be furnished to the Owner's Authorized Representative in hard copy at the time of the Systems Inspection before any Substantial Completion Date will be issued.
 - 3. It is the intent of irrigation design that it represent best practices for water conservation, energy resource conservation, and sustainable site design with a goal of achieving LEED design standards or certification.
- B. The work consists of furnishing and installing an underground irrigation system and, includes all labor, equipment and materials and perform all operations in connection with the construction of the irrigation system.
- C. Permits and Fees: Obtain all permits and pay required fees to any governmental agency having jurisdiction over the work. Inspections required by local ordinances during the course of construction shall be arranged as required. On completion of the work, satisfactory evidence shall be furnished to the Owner's representative to show that all work has been installed in accordance with the ordinances and code requirements. See existing utilities paragraph below.
- D. Coordination: Coordinate and cooperate with other contractors to enable the work to proceed as rapidly and efficiently as possible.
- E. Inspection of Site: Installer shall acquaint himself with all site conditions. Should utilities not shown on the plans be found during excavations notify the Owner's Authorized Representative. Failure to do so will make installer liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown on plans.
- F. Existing Utilities: Before any trenching, excavation or digging below the surface for any reason is begun, the contractor shall have the area utilities located in order to determine as close as possible the location of all underground utilities. The contractor will conduct his work in such a manner to protect all utilities from damage. It is the responsibility of the contractor to repair or replace any damage incurred by the contractors work or workers at no expense to the owner.
- G. Protection of Existing Site Conditions: The installer shall take necessary precautions to protect site conditions to remain. Should damage be incurred, the Installer shall repair the damage to its original condition at his own expense.
- H. Guarantee: All work shall be guaranteed for compliance with the drawings and specifications for a period of one year after the date of substantial completion. The contractor shall make good any deficiencies at the time he is notified of any faults, and place in satisfactory condition any damage

to the buildings or grounds without cost to the owner. All guarantees shall be in writing and approved by the Owner's Authorized Representative before submitting to the Owner.

1.02 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Licensed firms regularly engaged in manufacture of irrigation systems products of types, materials, and sizes required, whose products have been in satisfactory use in similar service.
- B. Installer Qualifications: Licensed firm regularly engaged in successful installation of irrigation systems similar to that required for project.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for irrigation system materials and products.
- B. Maintenance Data: Submit maintenance data and parts lists for irrigation system materials and products.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS:

- A. All pipes, mainline and laterals shall be schedule 40 PVC with ratings printed on pipe.
- B. All fittings for lateral pipe shall be PVC SCH 40 and 80 as detailed.
- C. All quick couplers shall be installed on pre-assembled swing joint.

2.02 DRIP AND SPRAY IRRIGATION EQUIPMENT

- A. Provide drip irrigation equipment (tubing, controller, automatic valves, piping, filters, emitters, etc.) approved by the Owner's Authorized Representative.
- B. Provide spray/bubbler irrigation equipment (controller, automatic valves, piping, heads, etc.) approved by the Owner's Authorized Representative.
- C. Provide irrigation equipment from one main source, with fully compatible components.

2.03 DRAIN VALVES AND VALVE MARKERS:

- A. All drain valves on pressure line shall be a 3/4" ball valve. Each valve shall have a 2" PVC sleeve with a valve marker cap and six inch valve box.

2.04 VALVE BOXES:

- A. Control valve boxes shall have a "T"-type bolt down lid. Valve boxes shall be of sufficient size as properly house and service equipment. Color of valve box lid is to match surrounding landscape. (ie. Green for turf areas, brown or grey for mulch areas.)

2.05 ELECTRICAL WIRE:

- A. Control wire shall be a direct burial cable PE insulated type not smaller than #14.

- B. For all wire connections to remote control valves and all splices of wire in the field, use 3M DBY connectors. All wire splices shall be in a box.

2.06 TRENCH BEDDING MATERIAL:

- A. Bedding material shall be a sandy material free of rocks. Where existing soil does not meet this requirement, imported material shall be used.

2.07 SLEEVES

- A. Pipe and control wiring and tubing under walks, roads and other hard surfaces shall be installed in Schedule 40 PVC sleeves or PVC Sewer pipe as noted on the plans.

2.08 BACKFLOW PREVENTER:

- A. As approved by Owner's Authorized Representative.

2.09 STOP AND WASTE VALVE:

- A. 1" Brass stop and waste valve.

2.10 QUICK COUPLER VALVE

- A. As approved by Owner's Authorized Representative.

2.11 GLUE

- A. As approved by Owner's Authorized Representative.

PART 3 EXECUTION

- 3.01 The contractor, prior to installing the system, must verify existing water pressure. If there is a failure to obtain the needed pressure or if an excess of pressure exists for normal operation, the contractor shall contact the Owner's Authorized Representative for any adjustments to the system. Failure to report any discrepancies in pressure due to whatever reason, and installation done prior to notification of Owner's Authorized Representative shall be done at the expense of the contractor.

3.02 TRENCHES

- A. Trenches shall be dug as deep and wide as necessary to properly place the irrigation piping. All trenches shall be backfilled and tamped sufficiently to insure no settling of the surface.
- B. The contractor, in placing the irrigation lines, etc. may uncover material not suitable for finished grading. This material shall be removed from the site. After the installation of the lines, the finished grading shall be smoothed over and restored to its original condition, using additional topsoil where necessary.

3.03 PIPE ASSEMBLY

- A. A bedding material shall be placed a minimum of 3" in all directions around all mainline pipes prior to backfilling. Lateral line pipes shall have a minimum of 3" in all directions.
- B. All mainlines shall be installed to a depth of 18 inches minimum.

IRRIGATION SYSTEM

Page 4 - SECTION 32 84 23

- C. All PVC lateral lines shall be installed to a depth of 12 inches minimum.
- D. Lines bordering curbs or sidewalks shall be 12 inches away to allow for maintenance and access to the lines.
- E. All mainlines greater than 2 inches in size shall be installed with thrust blocks wherever a change of direction occurs.
- F. When the lateral pipe lines are connected the control valves shall be opened and flushed with a full head of water to clean out the system.
- G. PVC joints shall be glued according to manufacturer's recommendations. Glued joints shall set for 24 hours before pressure is applied to lines. Before trenches are backfilled all lines shall be pressurized and checked for leaks.

3.04 DRAIN VALVES:

- A. Install drain valves at all low points on irrigation main line. All drain valves shall be of manual type for operation by handle keys. Drain valves in planted areas shall be provided with sleeve and marker. Drain valves shall be provided with a gravel sump not less than 12" X 12" in size and with gravel 3/4" to 1" in size to insure continued dependable drainage. Cover drain material with landscape filter fabric and backfill remainder with excavated material.

3.05 VALVES

- A. Control valves shall be located in landscaped areas. Avoid locating valves in areas of high pedestrian and vehicular circulation.
- B. Each bank or section of control valves shall be enclosed in an adequate size valve box and extensions to allow the disassembly of valves contained within. Valve boxes shall be at finished grade with valve stems 4 inches below top of box and with 4" of pea gravel under the valve. Isolation valves at all valve banks.

3.06 CONTROLLER AND CONTROL WIRES

- A. Install controller as per manufacture's recommendations and as detailed.
- B. All wire connections to valves and all splices shall be water tight.
- C. Control wires must be buried at least 12 inches below finished grade and bundled with a plastic tape every 20 feet. Provide boxes at direction changes greater than 45 degrees. Tie a loose 20" loop in all wiring in pull boxes. Where control wire leaves main or lateral line, enclose it in Class 200 PVC conduit.
- D. Install 2 spare wires from the controller to the farthest valve location.
- E. Electric controller shall be coded so that neutral wires are one color, grass area wires are one color, shrub area wires are another color and spare wires are another.

3.07 INSPECTION

- A. At the time of final inspection the entire system must then be tested in the presence of the Owner's Authorized Representative. It must operate in a satisfactory manner, with a full uniform coverage.
- B. Before the final inspection is complete, the contractor must furnish 'as-built' drawings. These drawings should be updated on a daily basis to assure accuracy. The drawings must show the

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location of all valves, pipe, heads, controller control lines, and drain valves used on the job. These drawings and maintenance manuals must be submitted at the time of final inspection or in accordance to the general conditions.

3.08 GUARANTEE

A. One year.

END OF SECTION 328423

SECTION 329000 – LANDSCAPING

PART 1 GENERAL

1.01 SUMMARY

- A. The extent of the landscape development work may include topsoil, ammendments, preparation of landscaped areas, placement of all plant materials, mulches, maintenance and guarantee.
 - 1. Subgrade Elevations: Landscape grading shall be restricted to placement of all topsoil and preparation of finish grade.
 - 2. It is the intent of landscape design that it represent best practices for water conservation, energy resource conservation, and sustainable site design with a goal of achieving LEED design standards or certification.
 - 3. Plantings in Parking Lot Islands: Trees planted in parking lot islands shall be provided with a subsurface drainage system to mitigate compacted soil conditions and poor drainage.

B. RECORD DRAWINGS

C. The Contractor will keep a record of all work that occurs during construction. The Owner's Authorized Representative will review the "record drawings" to verify the work is being recorded as construction occurs.

D. The Contractor to deliver to the Owner's Authorized Representative a copy of the record drawings in hard copy form prior to final payment.

1.02 QUALITY ASSURANCE

- A. The landscape work shall be done by a single licensed Landscape Contractor specializing in landscape work. The on-site supervisor must have a minimum of three years experience in landscape construction and one year experience in a supervisory role.

1.03 PLANT MATERIAL SOURCE QUALITY CONTROL

- A. General: Ship landscape materials with certificates of inspection as required by governmental authorities. Comply with governing regulations applicable to landscape materials.
- B. The source or supplier for all plant materials shall be furnished to the Owner's Authorized Representative prior to the delivery of any plant materials on site or stored elsewhere.
- C. Provide trees and shrubs, and other plant materials grown in a recognized nursery in accordance with good horticultural practice. Provide healthy, vigorous stock grown under climatic conditions similar to the locality of the project and free of disease, insects, eggs, larvae, and defects such as knots, sun-scale, injuries, abrasions, or disfigurement.
- D. Plant materials and other landscape items will be evaluated according to compliance with drawings, schedules, and specifications; as well as overall aesthetic quality, grower or supplier reputation, physical inspection, and American Association of Nurseryman Standards (AANS).
- E. All plant materials are to be inspected and approved by the Owner's Authorized Representative at the time of delivery on site. This approval does not constitute final acceptance of any plant material. All plant materials will be inspected again at time of final inspection and once again at

LANDSCAPING

Page 2 - SECTION 32 90 00

the end of the warranty period. Any plant found to be unacceptable at any of these inspections shall be immediately removed and replaced.

- F. Plant materials selection must come from the Plant Palette located in the ATC Master Plan Document. No substitutions.

1.04 PLANT MATERIALS

- A. Trees, shrubs, and other plants: Do not prune prior to delivery. Do not bend or bind-tie in such a manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery.
- B. Deliver plants after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set plants in shade, protect from weather and mechanical damage, and keep roots moist.
- C. Do not remove container-grown stock from container until planting time.
- D. Label at least one plant of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.
- E. Sizes: Provide plants of the sizes indicated below. Plants of a larger size may be used pending approval by the Owner's Authorized Representative and if sizes of root balls or containers are increased proportionately.

Deciduous Trees	2" caliper
Evergreen Trees	5' in height
Shrubs	5 gallon container
Perennial/grasses/ground covers	1 gallon container

1.05 STORAGE AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at the site.
- B. The Contractor shall check the materials upon delivery to assure that proper material has been received.

1.06 GRADING AND TOPSOIL

- A. Observe the conditions under which work is to be performed, and notify the Owner's Authorized Representative of unsatisfactory conditions.
- B. Topsoil Analysis: furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.

Provide topsoil analysis for imported topsoil.

1.07 EXISTING UTILITIES

- A. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required, to minimize possibility of damage to underground utilities. The Contractor shall have the utilities located prior to digging. It is the responsibility of the Contractor

to repair or replace any damage incurred by the contractor or the contractor's employees at no expense to the owner.

1.08 EXCAVATION

- A. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify the Owner's Authorized Representative before planting.

1.09 PLANTING SCHEDULE

- A. Prepare a proposed planting schedule for approval by the Owner's Authorized Representative. Schedule the dates for each type of landscape work during the normal seasons for such work in the area of the site. Correlate with specified maintenance periods to provide maintenance throughout the specified time period. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.
- B. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.

1.10 GUARANTEE

- A. The guarantee specified shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Guarantee trees, shrubs and other plants for one year following substantial completion against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.
- C. Remove and replace trees, shrubs or other plant material found to be unacceptable at the time of substantial completion and once again at the end of the warranty period. Replacements shall be made during the growing season and shall comply with all requirements and specifications. Any delay in the completion of any item of work in the planting operation which extends the planting into more than one season shall extend the guarantee period accordingly.
- D. Guarantee seeded and sodded areas through the specified maintenance period after substantial completion.

1.11 MAINTENANCE: Plant maintenance work shall consist of watering, weeding, caring for plants, edging and mowing, fertilizing, and performing the following plant establishment work.

- A. The entire project shall be satisfactorily maintained until substantial completion of the landscape. The maintenance period will begin when all items of work have been completed as specified in the foregoing articles until substantial completion. If project is not accepted, contractor shall be required to continue maintenance until project is accepted.
- B. All areas including sidewalks and gutters shall be clean and free of debris and weeds. All plant materials shall be live, healthy, free of infestations or weeds, and be of acceptable growth for the time of year. The contractor shall obtain written release from the Owner before ending maintenance

PART 2 PRODUCTS

2.01 TOPSOIL

- A. Topsoil: Imported topsoil is required in all landscape areas.
- B. Imported topsoil shall consist of natural sandy loam and be of uniform quality, free from subsoil, hard clods, stiff clay, hard-pan, sod, partially disintegrated debris or any other undesirable material. Soil shall be free of plants, roots, or seeds that would be toxic or harmful to growth. Topsoil shall be obtained from naturally drained areas and shall contain at least 2 percent organic material as determined by loss upon ignition of a moisture free sample that has been dried in accordance with current methods of the Association of Official Agricultural Chemists.
- C. Contractor shall furnish a certified report of an approved analytical chemist showing the analysis of the topsoil proposed for use, both stockpiled and imported. Topsoil shall have the follow analysis range.
- | | |
|-------------------------------|--------------------|
| pH | 5.0 - 8.2 |
| Soluble Salts | <4 ds/m or mmho/cm |
| Sodium Absorption Ratio (SAR) | 3-7 |
| Organic Matter | >2% |
| Sand | <70% |
| Silt | <70% |
| Clay | <30% |
- D. Furnish sample of topsoil to Owner's Authorized Representative prior to delivery of topsoil on site.
- E. Prior to the installation of any topsoil, Contractor shall inspect the existing subgrade for compliance to the specifications with regards to the grade and cleanliness. Any discrepancy shall be brought to the attention of the Owner's Authorized Representative for appropriate action.
- F. Spread the topsoil to the depths specified on the drawings – 12 inches for all landscape areas.

2.02 PLANT MATERIALS

- A. Quality: Provide trees, shrubs and other plants that comply with the recommendations and requirements of ANSI 260.1 "Standard for Nursery Stock" and as further specified. The Owner's Authorized Representative reserves the right to refuse plant materials, which does not meet the quality required for the project.
- B. Deciduous Trees: Provide trees of height and caliper listed or shown and with minimum branching configuration recommended by ANSI 260.1 for type and species required. Provide single stem trees except where special forms are shown or listed.
- C. Provide balled and burlapped (B&B) deciduous trees.
- D. Container grown deciduous trees will be acceptable in lieu of balled and burlapped deciduous trees and where specified in plant schedule subject to specified limitations of ANSI 260.1.
- E. Deciduous Shrubs: Provide shrubs of the height and size shown or listed and with not less than the minimum number of canes required by ANSI 260.1 for the type and height of shrub required.

- F. Container grown deciduous shrubs will be acceptable subject to specified limitations of container grown stock.
- G. Coniferous Evergreens: Provide unsheared evergreens of the sizes shown or listed. Provide normal quality evergreens with well balanced form complying with minimum requirements for other size relationships to the primary dimension indicated on the Planting Plans.
- H. Container grown evergreens will be acceptable subject to the specified limitations for container grown stock.
- I. Groundcovers/Perennials: Provide materials of the species and size indicated and grown according to ANSI requirements.

2.03 SEED AND SOD

- A. Provide seed that meets national quality requirements of a water conserving type as indicated on the Plant Palette in the ATC Master Plan Document. Provide source and grower information to Owner's Authorized Representative.
- B. Provide full-rooted sod of a water conserving type as indicated on the Plant Palette in the ATC Master Plan Document. Provide source and grower information to Owner's Authorized Representative.

2.04 MISCELLANEOUS MATERIALS

- A. Water: Potable.
- B. Chemical Fertilizer: Fertilizer shall be based on topsoil analysis.
- C. Herbicides: EPA registered and approved, of type recommended by manufacturer.
- D. Mulch: Submit samples before bringing onto project. All shrub planting beds shall receive a 3" mulch layer.
- E. Landscape Fabric: Landscape fabric to be a synthetic pervious sheet of polypropylene, nylon, polyester or ethylene yarn. Securing pins shall be galvanized steel 0.09 inch diameter, U-shaped with 6 inch legs.

PART 3 EXECUTION

3.01 COORDINATION

- A. The contractor shall coordinate his work with that of other contractors on site, and shall cooperate to the fullest extent to see that the work is completed in a timely and workmanship like manner.

3.02 INSTALLATION OF TOPSOIL

- A. Prior to the installation of any topsoil and mulch, contractor shall inspect the existing grade for compliance to the specifications with regards to the grade and cleanliness. Any discrepancy shall be brought to the attention of the Owner's Authorized Representative for appropriate action.

- B. When contract operations have been completed to a point where the areas will not be disturbed, finish grade shall be cleaned free of waste material of all kinds. Scarify and pulverize the subgrade to a depth of not less than 6" inches. Scarification shall be completed in all landscaped areas.

3.03 PREPARATION FOR PLANTING TREES AND SHRUBS

- A. The exact locations of all plants must be approved by the Owner's Authorized Representative prior to the digging of any holes. Refer to the drawings for the sizes and preparation of holes. Prepare all holes according to the details on the drawings.
- B. To avoid a soil water interface problem, excavated soil material from planting holes should be inspected by the Owner's Authorized Representative to determine if such soil should be used as backfill material. If it is determined that the excavated material is not of good quality, then it should be modified.
- C. Place landscape fabric and secure with metal pins.

3.04 TREE AND SHRUB PLANTING

- A. Prior to planting, fill excavated tree pit with water and allow to percolate out. If, after 24 hours, the water has not percolated out of the pit, notify the Owner's Authorized Representative. Do not plant until the problem has been corrected.
- B. The tree planting holes should be so that the top of the root ball is 2" above the adjacent finish grade. Trees must be placed on undisturbed soil at the bottom of the planting hole. The tree hole depth shall be determined so that the tree may be set at finish grade, using the top of the root ball as a guide.
- C. Set tree on soil, cut wire basket, remove burlap from top 2/3 of ball, and remove ALL twine, wrappings, etc.
- D. All tree holes shall be backfilled in 12-inch lifts and settled and tamped to minimize any settling of the tree.
- E. Upon completion of backfilling operation, thoroughly water the tree to completely settle the soil and fill any voids that may have occurred.
- F. The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches. All cuts, scars and bruises shall be properly treated according to the direction of the Owner's Authorized Representative. Proper pruning techniques shall be used. Do NOT leave stubs and do NOT cut the leader branch. Improper pruning shall be cause for rejection of the plant material.
- G. Saucers: Saucer shall be formed at the base and it shall be watered the same day as planting.
- H. Mulching: Upon completion of all planting operations, remove all undesirable material from the surface of the planting beds, including all rocks over the size of 1 1/2" diameter. Install the specified mulch in all shrub planting beds and tree basins to a uniform depth of 3".

3.05 SEEDING AND SODDING

- A. Conduct seeding and sodding operation in conformance to industry standards of high quality.

3.06 WEED CONTROL

- A. Weed control is required. The extent of control depends on the type, quantity, and stage of weeds. The following are methods that may be used to control weeds. Apply herbicide so no damage to protected vegetation occurs whether inside or outside of the project site. Damage to protected vegetation or vegetation outside the project site will be reimbursed to the Owner or replaced by the Contractor in a manner satisfactory to the Owner's Authorized Representative, and according to the International Society of Arboriculture Method of "Valuation for Landscape Trees, Shrubs, and Other Plants", latest edition.

- B. Post Emergent:

1. Mix and apply postemergent herbicide according to manufacturer's recommendations indicated in the "Weeds Controlled" section of the label, and apply to actively growing vegetation.
2. Apply the spray mixture so that all undesired vegetation is uniformly covered, but avoid causing overspray and drift. Spray target vegetation so that it is wet, but short of run-off.
3. Prune all suckers at the base of any trees to the soil level prior to application.
4. Do not apply postemergent herbicide in any of these conditions: When rainfall is expected within six hours; when there is growth stress as a result of drought, insects, disease, or plant damage; or when there is heavy dust on plants.
5. Do not walk or permit other traffic on treated areas when they are wet from application. Shoes and equipment may track spray solution to areas where vegetation is not to be treated.
6. Repeat application, as necessary to completely eradicate undesired vegetation.

- C. Pre-emergent:

1. Mix and apply pre-emergent herbicide according to manufacturer's recommendations and information on the side panel, and the following: Use granular applicators designed to apply herbicide at Manufacturer's suggested highest rate.
2. Calibrate the applicator according to the manufacturer's directions prior to use and check frequently during application to be sure the equipment is working properly and distributing the granules uniformly. Do not apply more than the recommended amount.
3. Apply granular herbicide according to manufacturer's recommendations and on site conditions and soil preparation requirements or restrictions appropriate to the herbicide used. The pre-emergent application must be followed within 8 hours with overhead watering or rainfall equivalent to 1/2".

- D. License: Use a State Licensed applicator to apply herbicide.

- E. Mechanical Control:

1. Mechanically control the weeds by pulling, cutting, hoeing, or by any other directed means approved by the Owner's Authorized Representative.
2. Weeds in a dormant stage or other condition which cannot be effectively controlled with postemergent herbicide shall be removed from the site by mechanical methods.

3.07 CLEANUP AND PROTECTION

- A. During landscape work store materials and equipment where directed. Keep pavements clean and work area in an orderly condition.

LANDSCAPING

Page 8 - SECTION 32 90 00

- B. Protect landscape areas, work and materials from damage due to operations by other contractors, trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.
- C. The contractor shall keep the site free from accumulation of waste material. At the time of completion, all areas must be swept or washed clean and all rubbish removed to the satisfaction of the Owner's Authorized Representative.

3.08 INSPECTION AND ACCEPTANCE

- A. When the landscape work is completed, the Owner's Authorized Representative will, upon request, make an inspection to determine Substantial Completion.
- B. The guarantee begins from the date of Substantial Completion.
- C. Where inspected landscape work does not comply with the requirement, replace rejected work and continue specified maintenance until re-inspected by the Owner's Authorized Representative and found to be acceptable. Remove rejected plants and materials promptly from the project site.
- D. As-built Drawings: Furnished to the Owner's Authorized Representative at the time of the Final Inspection before Certificate of Substantial Completion will be issued.

END OF SECTION 329000

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

1.1 SUMMARY

- A. Gravity-flow, nonpressure storm drainage outside the building.

1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.
- B. Not Used

1.3 COMPONENTS

- A. Backwater Valves: Gray iron.
- B. Cleanouts: Gray iron.
- C. Drains: Gray-iron area drains.
- D. Not Used.
- E. Manholes: Standard precast concrete and Cast-in-place concrete.
 - 1. Resilient pipe connectors.
 - 2. Reinforced-concrete grade rings.
 - 3. Protective coating.
 - 4. Manhole frames and covers.
- F. Polymer-Concrete, Channel Drainage Systems: Sloped-invert, Narrow-width, type with heavy duty ductile iron grates.
 - 1. Drainage Specialties: Small catch basins, oil interceptors and sediment interceptors.
- G. Not Used.
- H. Catch Basins: Standard precast, Designed precast and Cast-in-place concrete.
 - 1. Frames and grates: Cast or ductile iron, traffic rated.
- I. Stormwater Inlets: Curb, gutter and combination type.
- J. Stormwater Detention Structures: Cast-in-place concrete with manhole frames and covers.
- K. Pipe Outlets: Head wall, riprap basins, energy dissipaters.
- L. Dry Wells: Precast, perforated concrete rings and Constructed-in-place aggregate.
- M. Stormwater Disposal Systems: Chamber and Pipe type.

1.4 INSTALLATION

A. Gravity-Flow, Nonpressure Sewer Piping Applications:

1. Corrugated smooth interior PE drainage, PVC sewer and Reinforced-concrete sewer pipe.

B. Force-Main, Pressure Piping Applications:

1. NPS 2: PVC, Schedule 80 water-service pipe.
2. NPS 3: PVC, Schedule 80 pipe.
3. NPS 4 - 12: Ductile-iron, PVC pressure pipe.

END OF SECTION 334100

SECTION 334600 - SUBDRAINAGE

1.1 SUMMARY

- A. This Section includes subdrainage systems for the following:
 - 1. Foundations.
 - 2. Underslab areas.
 - 3. Plaza decks.
 - 4. Retaining walls.

1.2 MATERIALS

- A. Perforated-Wall Pipes and Fittings:
 - 1. PE corrugated pipe and fittings for coupled joints.
 - 2. PVC bell-and-spigot sewer pipe and fittings for loose joints.
- B. Solid-Wall Pipes and Fittings:
 - 1. Service class, hub-and-spigot cast-iron pipe and fittings for gasketed joints.
 - 2. PE corrugated drainage tubing and fittings for coupled joints.
 - 3. PE corrugated pipe and fittings for coupled joints.
 - 4. PVC bell-and-spigot-end sewer pipe and fittings for gasketed joints.
- C. Flexible Couplings: Unshielded.
- D. Cleanouts: PVC and concrete.

1.3 PRODUCTS

- A. Drainage Conduits: Single-pipe and Mesh fabric with gravel conduits.
- B. Not Used.

END OF SECTION 334600

SECTION 335100 - NATURAL GAS DISTRIBUTION

1.1 SUMMARY

- A. Natural gas piping outside the building.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working-Pressure Ratings:

1. Piping and Valves: 100 psig minimum, unless otherwise indicated.
2. Service Regulators: 100 psig minimum, unless otherwise indicated.
3. Service Meters: 65 psig.

1.3 QUALITY ASSURANCE

- A. Quality Standard: ANSI Z223.1 or NFPA 54.

1.4 MATERIALS

- A. Steel Pipe: Schedule 40.
- B. PE pipe and socket fittings.
- C. Service-line risers.
- D. Shutoff Valves:
 1. Nonlubricated, tapered plug valves.
 2. Lubricated, tapered plug valves.
 3. Ball valves.
 4. Lubricated plug valves.
 5. Nonlubricated plug valves.
 6. PE valves.
- E. Valve boxes.
- F. Earthquake, automatic-shutoff valves.
- G. Service Regulators: Single-stage, steel jacketed.
- H. Service Meters: Furnished by gas utility.
- I. Concrete bases.

1.5 INSTALLATION

A. Aboveground Piping:

1. NPS 2 and Smaller: Steel pipe and malleable-iron fittings with threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe and fittings with welded joints.

B. Underground Piping: PE pipe and fittings with heat-fusion joints.

C. Connection to Existing Gas Main: By gas utility.

END OF SECTION 335100

